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National Institute on Alcohol Abuse and Alcoholism

Project MATCH Hypotheses: Results and Causal Chain Analyses

PROJECT MATCH MONOGRAPH SERIES

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National Institute on Alcohol Abuse and Alcoholism
Project MATCH Monograph Series
Volume 8

Project MATCH Hypotheses: Results and Causal Chain Analyses

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For further information on Project MATCH and a list of the study's publications, see http://www.commed.uchc.edu/match. The NIAAA website is http://www.niaaa.nih.gov.

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Project MATCH Monograph Series

The following publications are available from the National Institute on Alcohol Abuse and Alcoholism, Publications Distribution Center, P.O. Box 10686, Rockville, MD, 20849–0686.

Volume 1 — *Twelve Step Facilitation Therapy Manual: A Clinical Research Guide for Therapists Treating Individuals With Alcohol Abuse and Dependence*, by J. Nowinski, S. Baker, and K.M. Carroll. NIH Publication No. 94–3722.

Volume 2 — *Motivational Enhancement Therapy Manual: A Clinical Research Guide for Therapists Treating Individuals With Alcohol Abuse and Dependence*, by W.R. Miller, A. Zweben, C.C. DiClemente, and R.G. Rychtarik. NIH Publication No. 94–3723.

Volume 3 — *Cognitive-Behavioral Coping Skills Therapy Manual: A Clinical Research Guide for Therapists Treating Individuals With Alcohol Abuse and Dependence*, by R. Kadden, K.M. Carroll, D. Donovan, N. Cooney, P. Monti, D. Abrams, M. Litt, and R. Hester. NIH Publication No. 94–3724

Volume 4 — *The Drinker Inventory of Consequences (DrInC): An Instrument for Assessing Adverse Consequences of Alcohol Abuse*, by W.R. Miller, J.S. Tonigan, and R. Longabaugh. NIH Publication No. 95–3911.

Volume 5 — *Form 90: A Structured Assessment Interview for Drinking and Related Behaviors. Test Manual.* by W.R. Miller. NIH Publication No. 96– 4004.

Volume 6 — *Improving Compliance With Alcoholism Treatment*, K.M. Carroll, editor. NIH Publication No. 97–4143.

Volume 7 — *Strategies for Facilitating Protocol Compliance in Alcoholism Treatment Research*, A. Zweben, D. Barrett, K. Carty, B. McRee, P. Morse, and C. Rice, editors. NIH Publication No. 98–4144.

Volume 8 — *Project MATCH: Hypotheses, Results, and Causal Chain Analyses*, R. Longabaugh and P.W. Wirtz, editors. NIH Publication No. 01–4238.

Foreword

The editors and authors are to be warmly applauded for their work in developing this unique monograph. Although Project MATCH officially concluded in 1997, not all analyses and interpretations of this rich data set were complete at that time. In this work, Drs. Longabaugh and Wirtz and their authors make particularly insightful and rigorous contributions not previously published.

This volume is the first systematic and comprehensive treatment of causal chain analysis of interventions for alcohol problems. Causal chains are theory-based models of the change process underlying intervention effects. Causal chains specify a testable sequence of steps postulated to be necessary and sufficient occurrences leading to an intervention's effects. The Project MATCH design included causal chain testing for all of the tested hypotheses.

In the initial chapters, the editors lay the methodological groundwork developed in Project MATCH for testing the causal chains associated with the matching hypotheses. The subsequent 18 topical chapters examine each of the hypotheses tested in Project MATCH and provide a rich array of approaches to conceptualizing and testing the associated causal chains. In the final two chapters, the editors provide a comprehensive and thoughtful critique of the preceding topical chapters and bring in new analytic approaches not available at the time of the original MATCH analyses. Their discussions shed light on why MATCH produced the findings it did and what this implies for future matching research and treatment research in general.

The primary audience for this volume is treatment researchers engaged in testing the efficacy of interventions. It offers a systematic guide to specify, classify, and test causal chains. The message to the field is that as we test the efficacy of interventions, we would do well to assure that we also specify a theory-grounded basis for our hypotheses and make use of methodology to test the causal chains underlying intervention effects. We recognize that the field has far to go in understanding the mechanisms by which behavioral interventions for alcohol problems exert their effects and how this knowledge might ultimately be used to improve outcomes. This pioneering volume is to be recommended to the research community as important guidance in this endeavor.

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Preface

In this, the final volume of the Project MATCH Monograph series, the editors and chapter authors address aspects of the Project MATCH findings absent from previous publications. Matching was a promising approach for alcoholism treatment from the 1970s through the mid 1990s but, after MATCH reported no compelling support for the concept, many puzzling issues were raised. Why were relatively few significant matches found? Why were the effects of these matches small in size and inconsistent across time, outcome measure, and setting? How well developed were the theories underlying the matching hypotheses? Did the design and analytic methods used in Project MATCH permit a fair test of the hypothesis? Does the dearth of compelling matching findings imply that matching is no longer a relevant topic for treatment research?

Whereas previous MATCH publications have reported on *what* works, the emphasis here is on the *why* (or why not) behind the observed effects. In focusing on testing treatment matching theory, the editors and authors undertake several daunting tasks: a review of the rationale of the hypotheses; a summary of all reported and unreported matches from the enormous Project MATCH data base; a description of the causal chains postulated for the hypotheses; and the analytic methods employed to test the causal chains.

The term "causal chains" may be new to many. It refers to the sequence of steps (or pathway) postulated to lead from the intervention to its outcome(s). It specifies aspects of treatment, patient characteristics, or other factors linking the operative components of the intervention to intermediary processes that, in turn, lead to changed drinking behavior. This mechanism of action concept is fundamental in medicine and is analogous to, for example, the steps in a pharmacologic pathway, which may involve the metabolism of a drug to its active species, its binding to a particular enzymatic site, and its alteration of a biochemical reaction that leads to a change in the physiological state of the organism. In this volume, we see a systematic application of the concept of causal mechanisms and their testing in the realm of behavioral sciences.

An understanding of the causal sequence of events can inform us how and why the interventions were or were not effective. This constitutes a step beyond efficacy testing which determines *if* an intervention works. The pathway idea is built around the concepts of mediators and moderators, variables that change the relationship between the independent variable (i.e., treatment) and the outcome variable (i.e., drinking).

Mediators explain the "why and how" of the effect, whereas moderators influence the strength of the association between independent and outcome variables. Given the many behavioral and environmental factors shaping alcohol addiction, it is not surprising that the picture grows more complicated in Project MATCH, which examined the mediation of moderator effects.

The authors summarize the work done by Project MATCH investigators using the analytic models extant at that time, that is, the late 1980s and early 1990s. The editors reflect on that effort and also bring to bear thinking developed in other fields since that time. They offer a critique on why Project MATCH yielded the results it did and go on to provide a theoretical and analytic model for an approach that could fruitfully become a standard aspect of treatment research in the future.

This important work has the potential to significantly advance alcoholism treatment research by stimulating other theory-driven work on the causal mechanisms of treatments for alcohol abuse and dependence. Improved understanding of the active ingredients of treatment might well contribute to: (1) more accurate models of treatment and placebo effects; (2) more efficient and parsimonious interventions; (3) a more informed justification for combining interventions; and (4) better facilitation of the transfer of treatment research findings to practice settings.

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Purpose of the Monograph

Richard Longabaugh, Ed.D., and Philip W. Wirtz, Ph.D.

Project MATCH was conducted to provide a rigorous, large-scale study of the client-treatment matching hypothesis, a topic of keen interest to the alcohol treatment community. The generic matching hypothesis states that client outcomes can be improved by matching clients of known characteristics to specified treatments. The result of successful matching is that clients in the "matched" condition have better outcomes than similar clients assigned to an alternative treatment. The results of testing the matching hypothesis have been widely disseminated in several key Project MATCH publications (Project MATCH Research Group 1997*a*, *b*, 1998*a*, *b*, 1999) and a book that summarizes the study and its numerous contributions to the knowledge base (Babor and Del Boca, in press).

As is widely acknowledged (Project MATCH Research Group 1998*b*), evidence for matching effects was disappointing. Despite the promise of earlier matching studies (Mattson et al. 1994), the intuitively appealing notion that matching can appreciably enhance treatment effectiveness has been severely challenged. Why were so few successful matches found (Project MATCH 1997*b*, p. 1690)? It may be that matching clients based on single attributes is simply not an effective strategy to alter drinking outcomes, that is, acceptance of the null hypothesis of no effect. Or perhaps the study design was flawed in some essential way that prevented an adequate test of the hypothesis. A less obvious but critical issue is that perhaps our understanding of matching processes was inadequate, leading to flawed assumptions about the operatives involved and unsupportable hypotheses.

The purpose of the present volume is to examine this latter alternative in detail. It is important to conduct this exercise for the following reason. If the theory underlying each of the 40 predictions was adequate and yet the matches were not supported by the study results, then one would be justified in concluding that the tested matches are not important in assigning treatment, and that the theories underlying those matches are also invalid. Indeed, matching as a generic concept would be severely challenged. If, on the other hand, the matching predictions were based on inadequately developed theory, then perhaps Project MATCH did not give the generic hypothesis of client-treatment matching a fair test.

This volume focuses on what has been learned from examination of the theories underlying each of the matching hypotheses. The rationale for each a priori matching prediction is presented, as well as a complete description of the results of testing each prediction. Thus, our objective is to present the results of testing the theories from which each matching prediction was derived in greater depth than has been provided in other publications.

Preview of the Monograph

Part I describes the design and methodology used in Project MATCH. The first chapter provides a detailed introduction to the development of the matching hypotheses and discusses key design and statistical decisions made by Project MATCH to guide the testing of these hypotheses. The second chapter presents a detailed discussion of the causal chain analyses used to examine the theories underlying these hypotheses. It also describes a typology for organizing the voluminous data resulting from testing the matching hypotheses and their underlying theoretical frameworks. This provides the context

for the chapters presenting the individual matching hypotheses, results, and causal chain analyses.

Each of the 18 topical chapters follows the same general organization. First, the empirical and theoretical rationale is provided for the matching predictions, as well as the predictions themselves. Each matching variable is operationally defined, as are other variables to be included in the analyses. Next, a causal chain is provided to test the linkages hypothesized to underlie the anticipated matching effect. The data analysis plan is summarized, followed by a presentation of the results of tests of each matching prediction and its underlying causal chain. Each matching hypothesis and causal chain was tested twice, once with outpatients and once with aftercare clients. Usually, these results are presented separately. Finally, each chapter concludes with a discussion of the results of testing predictions involving this particular matching variable.

We have loosely grouped these chapters by sections. Part II has two chapters devoted to constructs pertaining to the severity of alcohol dysfunction, namely, alcohol dependence and alcohol involvement. Part III includes matching variables having to do with psychological dysfunction. The first chapter focuses on cognitive impairment. The next chapter, psychopathology, reports the results of testing predictions from two correlated matching variables, psychiatric severity and axis I psychiatric diagnoses. The third chapter in this section also focuses on two correlated matching variables, sociopathy and antisocial personality disorder. The last chapter in this section is concerned with the A versus B alcohol typology.

Part IV presents variables in the domain of person trait variables: anger, conceptual level, meaning seeking, prior religious beliefs and behaviors, interpersonal dependency, and gender.

Part V includes person variables that are conceptualized as more state- rather than trait-like in their nature. Two chapters are devoted to measures of motivational readiness: readiness to change and alcohol problem recognition. The last chapter in this section addresses two correlated measures of self-efficacy: temptation, and temptation minus confidence.

In Part VI, the focus changes to constructs which address the clients' relationships to their interpersonal environment: network support for drinking, prior involvement with Alcoholics Anonymous, and client social functioning.

As each of these chapters has a major content focus in its own right, we recommend that the reader first approach them selectively, according to specific interest.

Finally, the concluding chapters of this monograph again approach the subject of matching as the end point in its own right. Here we attempt to summarize and critique what we have learned from Project MATCH's decade-long quest to contribute to client-treatment matching theory.

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Part I: Design and Methodology

Matching Hypotheses

Causal Chain Analysis

Matching Hypotheses

Richard Longabaugh, Ed.D., and Philip W. Wirtz, Ph.D.

Project MATCH was the largest randomized clinical trial of a psychosocial treatment for alcoholism ever undertaken, involving 1726 clients, 10 universities, and 10 clinical research units in a collaborative study with the National Institute on Alcohol Abuse and Alcoholism. Three treatment modalities were compared, and 21 client characteristics were tested as matching variables. For each matching variable, one or more hypotheses were developed to predict which treatments would be most and least helpful to clients who differed on that variable. The client population studied had a current DSM-III-R diagnosis of alcohol abuse or dependence. Clients had to be at least 18 years old and could not be currently dependent on sedative/hypnotic drugs, stimulants, cocaine, or opiates nor could they have used any intravenous drug in the prior 6 months. Clients were comprehensively assessed (Connors et al. 1994) prior to random assignment to one of the three treatments and then were followed at 3-month intervals for a year after treatment completion. In the outpatient arm of study, clients were again interviewed at 3 years after treatment completion.

The design chosen to test the matching hypotheses in Project MATCH was only one of several viable alternatives. While scientific considerations were primary in the eventual design selected, other factors came into play once scientific criteria were met. Examples of these factors are described below.

Treatments

A matching study might well have started by selecting a client variable to which to match (e.g., gender) and then embarked upon developing a treatment that would be tailored to gender needs, perhaps maximizing the chances of finding matching effects. We however selected our treatment modalities first and then chose the client attributes that might be differentially affected by assignments to these treatments. Thus, matching hypotheses were developed after treatments had been decided upon. We might have increased the robustness of matching effects had we first developed the hypotheses and then designed treatment modalities to maximize the differences between the treatments by embodying active ingredients thought to be differentially effective in interaction with the client attribute.

The treatments chosen were Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992), Motivational Enhancement Therapy (MET; Miller et al. 1992), and Twelve Step

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Facilitation (TSF; Nowinski et al. 1992). They were selected on the basis of several criteria (Donovan et al. 1994) :

- Demonstrated clinical effectiveness
- Potential for revealing matching effects
- Applicability to existing treatment programs and client populations
- Distinctiveness from the other MATCH treatments selected
- Feasibility of implementation within the constraints of a research trial.

Cognitive-behavioral therapy had been shown to be effective in a great number of studies, was widely used in academic settings, had been delivered to alcohol dependent populations in a great many studies (Holder et al. 1991), and could be delivered within a short period. Several of the principal investigators had previously conducted randomized clinical trials involving variations of CBT.

While we had considered a no-treatment control group, ethical and practical considerations precluded this. Our search for a minimum treatment comparison group led to the selection of MET, a specific application of motivational interviewing (Miller and Rollnick 1991). Motivationally based brief intervention had been shown to be effective in a number of studies (Holder et al. 1991). Because of its philosophy of maximizing utilization of client resources, it was thought to provide a significant contrast from CBT, which assumed that the road to recovery was through teaching new skills to the client. Consequently, many of the matching predictions developed were predicated in whole or in part on the expectation that four sessions of MET would be insufficient for clients with severe problems in various areas.

TSF was selected because of the popularity of the Minnesota Model in the treatment field. Fundamental to the Minnesota model are the Twelve Steps of Alcoholics Anonymous and the integration of treatment with the client's involvement in AA. Despite the popularity of this treatment approach, its effectiveness had not received adequate rigorous testing (Miller and Hester 1986). The opportunity to provide a rigorous test of the model in the context of client-treatment matching was compelling. It was expected that its treatment philosophy, which included a reliance on support groups and a higher power, would differ markedly from the MET focus on utilization of client resources and CBT's focus on individual skill development guided and taught by the CBT therapist.

Other treatment modalities were seriously considered, for example, the Community Reinforcement Approach (CRA). It was decided not to select CRA in view of perceived difficulties in implementing it across 10 clinical research units (CRUs). One pharmacological intervention, naltrexone, was also considered but was judged to not have sufficient evidence for its effectiveness at that time to warrant its inclusion in a major multisite test of matching.

The study design compared treatment modalities within two distinct treatment settings (or arms), aftercare and outpatient. The CRUs successful in the competition for the cooperative agreement grants were located at sites that had access to either inpatient or freestanding outpatient programs. The outpatient arm involved clients who had not had an inpatient treatment immediately preceding their involvement in the MATCH trial. In the case of CRUs attached to inpatient units, an aftercare study was conducted because it was deemed infeasible to superimpose the MATCH treatment on the inpatient program. The study was not conducted as an aftercare versus outpatient matching study because clients could not be randomly assigned to treatment setting.

Dependent Variables

As the study was of alcohol treatment effectiveness, one or more measures of alcohol consumption were to be included as primary dependent variables. Among a large number considered, percentage of days abstinent (PDA) and average drinks per drinking day (DDD) were chosen. PDA was an easy selection as it had high usage in prior studies and provided a relatively straightforward measure of drinking frequency (Babor et al. 1994). The selection of DDD was much more difficult. The goal was to index

drinking intensity, a dimension of drinking typology that was empirically associated with, but conceptually independent of drinking frequency.

Several candidates were considered, the leading contender among them being percentage of heavy drinking days. This measure was not selected, however, because of difficulty in designating a "heavy drinking day". While earlier research had frequently used six or more drinks as a cutoff, changes in cultural practices in the United States suggested that this figure was now too high. Furthermore, it was becoming clear that males and females differed in the effects of consuming the same amount of alcohol. Also, body weight and other factors were refining the conception of risky alcohol consumption. We concluded that what constituted a heavy drinking day was a moving target. DDD was selected because it represented an index of absolute amount of alcohol consumed (measured in standard drinks), independent of what might eventually be determined to constitute hazardous drinking intensity.

DDD had the major disadvantage that clients who had no drinking days during a period would have no data point. As this was likely to be so for a sizable percentage of clients within any followup period, this was unsatisfactory. Instead we opted to include in the analyses clients who had zero drinks on a "drinking day". This retained all clients in the analysis who were successfully followed up but also ensured that there would be a hefty correlation between PDA and DDD during the posttreatment period. The decision to include "zero drink drinking days" also resulted in a heavy concentration of observations at zero drinks per drinking day. This led to a methodologically determined lack of independence between the two primary dependent variables.

Primary dependent variables were limited to two in order to preserve the power to detect credible differences. Using the same two made it possible to preserve a standard metric for comparing matching effects across different matching variables.

Another promising construct for a primary dependent variable was believed to be negative consequences of alcohol consumption. However a disadvantage was that, at the time, there was no standard measure of negative consequences (Zweben and Cissler 1996). Alcohol dependence was also considered but discarded because it was an ambiguous construct that was difficult to quantify. Total abstinence was excluded as a primary dependent variable because of its insensitivity to major changes in drinking patterns that did not involve total abstinence and because of the relatively low percentage of clients who would be likely to achieve total abstinence throughout the entire recorded followup period.

Hypothesis Selection

The development of client-treatment matching hypotheses in Project MATCH was a significant departure from previous research on matching which was accomplished via single-site, smaller scale studies (Mattson et al. 1994). Because of the nature of the multisite collaborative study, a Steering Committee (SC) was authorized to develop the research hypotheses and the design to test these hypotheses as well as to assume collective responsibility for conducting the study and reporting the findings. The 11 principal investigators and other senior investigators involved in the process published main findings papers under the corporate authorship identified as the Project MATCH Research Group, PMRG (Project MATCH 1997*a*).

At the outset, the SC decided that rather than testing one or two matching hypotheses, several would be tested. Members of the PMRG formed self-selected groups called matching hypothesis teams (MHTs). Typically each team was composed of three to five members, including at least one statistician/methodologist and one or more clinical scientists who were well versed in the substance of the matching variable. Each team was charged to develop predictions about matching a single client attribute to one or more of the three study treatments. These were then presented to the entire SC, which had the responsibility for deciding which matching variables and a priori hypotheses would be selected for testing in the trial.

So that the entire SC would be fully informed in making these decisions, a procedure and

review process was put into place. Each MHT developed a 10–20 page document presenting the rationale for selection of a given client variable and rationale for each of the matching predictions proposed. The rationale included a review of published empirical support for use of the variable in matching research and a theoretical justification for the matching predictions made. Central to the theoretical justification was a "causal chain" (discussed in detail in the next chapter) that would provide a description of the underlying process (or processes) postulated to be necessary for the matching prediction to be supported. The procedures for operationalizing the matching variable were specified as well as analytic methods to test the predictions.

Each MHT document was submitted to a matching hypothesis review team composed of the editors of this volume, RL and PWW, whose primary expertise was, respectively, substantive and methodological/statistical. This review team critiqued the document and determined if it was ready for review by the full SC. Eventually each matching hypothesis was discussed, critiqued, and voted upon by the full SC to determine whether it would be included as one of the matching hypotheses.

This process was intensive and lengthy, spanning approximately 2 years during the planning phase. First, the document developed by the MHT had to pass the team's own review. Then, critique by the review team was followed by one and usually several iterations with the MHT before the document was ready for consideration by the full SC. Typically, on first presentation, the SC did not vote acceptance but raised questions and returned the document to the MHT for further revisions. The revised manuscript would then again undergo one or more iterations between the review team and the MHT before being resubmitted to the full SC for further deliberation. At that point, the matching hypothesis would be voted in or out. This last step was not perfunctory. In total, 28 matching variables were proposed by MHTs to the SC. Of these, 21 were tested in matching predictions.

Many of the variables selected for matching had been previously researched in single-site studies by members of the SC: Alcohol Involvement (Miller, Rychtarik,), Alcohol Dependence (Babor, Cooney), Psychiatric Severity (Cooney, Kadden), Sociopathy and Antisocial Personality Disorder (Cooney, Kadden, Litt, Longabaugh), Cognitive Impairment (Cooney, Donovan, Kadden, Longabaugh), Motivation (Carbonari, DiClemente, Miller, Tonigan), Self-Efficacy (DiClemente), Typology (Babor, Litt), Social Support (Longabaugh, Stout), Social Functioning (Cooney, Kadden), Interpersonal Dependency (Longabaugh), and Alcoholics Anonymous (Tonigan).

Given the treatments selected and the demonstrated potential of most of the matching variables, a primary focus of the matching hypothesis teams was development of the rationale for making client-treatment matching predictions, that is, why one or the other of the three already selected treatments would be likely to have a differential effect on the client matching variable.

How many treatments were to be included in the individual matching hypotheses was left up to the matching hypothesis teams. Some teams chose to develop predictions that involved contrasting matching effects for all three treatments, while other teams selected just two of the three treatments in their contrasts. Still others included all three treatments in the matching predictions but aggregated two together and compared the aggregate against the third. Any such aggregation was based on theory; for example, one treatment included an active ingredient thought likely to especially effect clients with a given attribute, whereas the other two treatments lacked or deemphasized this active ingredient. Another factor was the MHT's belief in the likely strength of the predicted matching effect. Teams believing that the matching effect was likely to be robust were more apt to include more predictions.

The SC decided during this review process that not all matching hypotheses would have equal status. One group was designated as *primary matching hypotheses*. They were given a higher priority because the SC felt they had a more compelling rationale because either their prior empirical support was stronger or the theory underlying the expected matching effects was more persuasive.

A second group of client variables was designated to test *secondary matching hypotheses.* Matching predictions involving these variables were also developed a priori but were deemed of lesser priority because their empirical and/or theoretical rationale was seen as less persuasive. By the end of the review process, 9 matching variables were accepted by the SC as primary and the remaining 12 as secondary. Had our results supported this designation of primary versus secondary hypotheses, much more would have been made of the distinction. While earlier publications reported the results of primary (Project MATCH Research Group 1997*a*) and secondary (Project MATCH Research Group 1997*b*) matching hypotheses, that distinction has proved unnecessary and is not used in this monograph. Table 1 lists all of the Project MATCH matching hypotheses.

Client-Treatment Interactions

For our purposes, an interaction is said to occur when a differential response to two treatments occurs as a function of the degree to which a client possesses a particular characteristic. Project MATCH allowed matching effects to involve interactions that were either *ordinal* or *disordinal.* A *disordinal* interaction was judged to occur when the two slopes were observed to cross one another at some point along the measurable client attribute continuum (figure 1), such that clients at one interval on the continuum were found to have better drinking outcomes when assigned to one treatment, but clients at another interval on the continuum were found to have better drinking outcomes when assigned to the contrasting treatment.

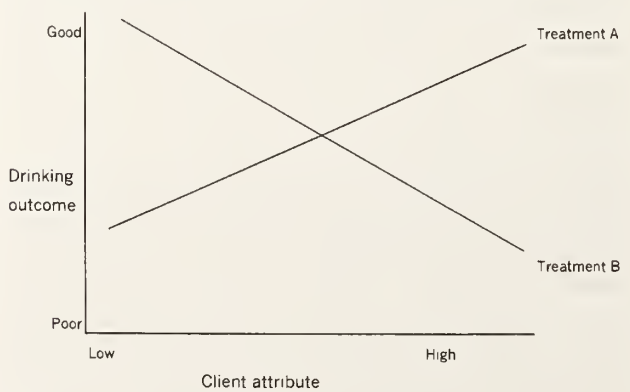

Figure 1. Disordinal interaction

If, in contrast, at one interval along the client attribute continuum, clients were found to have better drinking outcomes when assigned to one treatment but clients elsewhere on the continuum were found to have neither better nor worse drinking outcomes, then the interaction was designated as *ordinal* (figure 2).

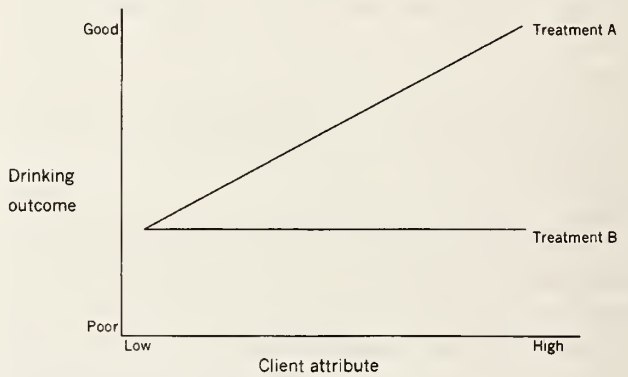

Figure 2. Ordinal interaction

In Project MATCH, we were interested in detecting both disordinal and ordinal interactions, even though disordinal interactions were more likely to have immediate wide-ranging implications for the field. Because of their theoretical value as well as their more limited immediate clinical value, interactions hypothesized to be ordinal were also approved by the SC.

All attribute-treatment interaction effects were hypothesized to be linear. Therefore, it was expected that the further up or down the range of the client attribute scale the actual value is, the more likely the treatments are to lead to different outcomes. Had a nonlinear interaction been hypothesized (or observed), the detection procedure would have become much more complex.

Ordinal Interactions at the Nonpredicted End of the Continuum

We did not specify as essential evidence for matching that the observed difference between the treatments occur at the end of the continuum where we expected the matching effect to

Table 1. Summary of hypothesized contrasts for each matching variable

Matching variable	Hypothesized contrast of slopes or differences between means[a]		
	CBT vs. MET	TSF vs. MET	CBT vs. TSF
Alcohol Dependence			TSF > CBT
Alcohol Involvement[b]	CBT[c] > MET	TSF[c] > MET	
Cognitive Impairment	CBT > MET	TSF > MET	TSF > CBT
Psychopathology and Severity	CBT > MET		CBT > TSF
Sociopathy and ASPD	CBT > MET	TSF > MET	CBT > TSF
A versus B Typology[b]	CBT[c] > MET	TSF[c] > MET	
Anger[b]	MET > CBT[c]	MET > TSF[c]	
Conceptual Level		MET > TSF	
Meaning Seeking[b]		TSF > MET[d]	TSF > CBT[d]
Religiosity[b]		TSF > MET[d]	TSF > CBT[d]
Interpersonal Dependency[b]		TSF > MET[d]	TSF > CBT[d]
Gender			CBT > TSF
Motivational Readiness	CBT > MET		
Problem Recognition[b]	CBT[c] > MET	TSF[c] > MET	
Self-Efficacy confidence	MET > CBT	MET > TSF	
Temptation minus confidence		TSF > MET	
Network Support for Drinking	CBT > MET	TSF > MET	
Prior AA[b]		TSF > MET[d]	TSF > CBT[d]
Poor Social Functioning	CBT > MET		CBT > TSF

[a] The hypothesized contrasts predict differences in slopes of the regression lines for each treatment on outcome as a function of client attribute. With the exception of the gender and typology attributes (which take on only discrete values), all contrasts take the form: The difference between the first treatment and the second becomes more positive (or less negative) with increasing values on the attribute. The gender and typology attributes take the form: The difference in means between the treatments is greater at one level of the attribute than at the other. Hypotheses did not test whether interactions were ordinal or disordinal.

[b] The rationale underlying the alcohol involvement, meaning seeking, typology, anger, religiosity, interpersonal dependency, problem recognition, and prior AA hypotheses assumes that, pertinent to the putative active ingredients involved in the hypothesized matching effect, two treatments are not different in their effect. Therefore, they were combined into a single condition which was then contrasted with the third treatment.

[c] Combined TSF and CBT treatment groups

[d] Combined MET and CBT treatment groups

be apparent. Thus, it was possible that some interactions would be observed at the "wrong end" of the variable continuum; this may be a somewhat difficult point to grasp and therefore can perhaps be best understood by an example.

In Project MATCH, the matching hypothesis team predicted that CBT would be more effective than TSF or MET for clients with higher psychopathology. This assertion was made with the knowledge that some components of the CBT treatment are designed to treat psychopathology while this is not so for either TSF or MET. Thus, the attribute-treatment interaction was predicted to occur because the CBT slope would be more positive than would the TSF or MET slopes, that is, as client psychopathology increased, it would be expected that CBT clients would have increasingly more favorable drinking outcomes than would TSF or MET clients. However, we instead found that with *decreasing* psychopathology, TSF clients had increasingly better outcomes than did CBT clients. The treatment triaging implication is to assign low psychopathology clients to TSF and not to CBT, rather than to assign high psychopathology clients to CBT and not to TSF.

But does this triage implication mean that the matching hypothesis is unsupported? Examination of the attribute-treatment interaction (see figure 2, page 88) reveals that the relative position of the two slopes is as predicted. As psychopathology increases, the outcomes of CBT clients are relatively better than at lower levels of psychopathology. In contrast, as psychopathology of TSF clients increases, their outcomes are not relatively better than at lower levels of psychopathology. As a result, the CBT slope is more positive than is the TSF slope, as was predicted from the rationale leading to the matching prediction.

Thus, the matching effect indicates that CBT is worse than TSF for clients without psychopathology. Clearly, evidence for and against the matching hypothesis is incomplete. It may be that TSF is a more effective treatment than CBT for the average alcohol dependent client because TSF has more of a particular active ingredient that would help all alcohol dependent clients irrespective of their psychopathology. However, because of CBT's unique effectiveness for clients with greater psychopathology, it is able to close the gap of effectiveness between TSF for clients with high psychopathology. Other explanations are also conceivable.

What is critical for the purpose of making the present point is that, as predicted, (1) the CBT slope was more positive than the TSF slope in the direction predicted at the required level of statistical significance and (2) at some interval along the client attribute continuum clients assigned to one of the two treatments would have better drinking outcomes than clients assigned to the other treatment, while this was not so for the remainder of the client sample.

In this example, all of the criteria specified for meeting the MATCH requirements for a matching effect were met. However, whether the theory underlying the matching effect is supported cannot be determined from outcome data alone. The causal chain analyses presented in this volume contribute to the interpretation of the matching results by examining further pertinent information.

Clinical Significance

If a disordinal interaction occurs, the clinical implications are obvious. The clinician would assign clients to the treatment that is best for clients with similar characteristics. All other factors being equal, those having a low score on the attribute should be assigned to treatment A, while those with a high score on the attribute should be assigned to treatment B.

Had Project MATCH found several disordinal interactions, the value to the treatment field would have likely been considerable. However, disordinal interactions were found for only three client attributes—client anger and network support for drinking in the outpatient arm of study (although ordinal interactions were hypothesized in each instance) and client dependence on alcohol in the aftercare arm of study.

The clinical benefits to the treatment field of an ordinal interaction are less obvious. A first reaction is, if clients with one score on the attribute do better in one treatment, but there is no difference between treatments on the outcome for clients with other scores on the attribute, then assign them all to the treatment that

has been found to be more effective for at least some of them, and no worse for the others.

However, the decision tree may become more complex when other considerations are taken into account. Two examples of considerations that may influence treatment choice involve practical issues. For example, if the treatment that is more effective for some requires more resources to deliver than the other, then this treatment might be reserved for only those clients who are likely to incrementally benefit. This is the rationale for assigning clients to different levels of treatment intensity, such as inpatient versus outpatient treatment.

Another consideration is the availability of the treatments contrasted. If a given program has only a limited number of therapists who have been trained to deliver the treatment that is more effective for some, but has other therapists available who can deliver the other treatment that is not less effective for the others, then the program might well assign clients with nondiscriminating scores to this other treatment.

Matching Hypotheses

As operationalized in Project MATCH, a client-treatment matching hypothesis is a prediction about the occurrence of a statistically significant interaction between a client attribute and a treatment modality, such that the predicted regression slopes of the contrasted treatments over the range of the client attribute are different from one another in a direction consistent with the theory. Graphically, this is evident when the slopes of the regression lines of the compared treatments on client outcomes are significantly different from one another in the hypothesized direction across the range of values of the client attribute. The criterion for statistical significance was achieved when a one-tailed prediction had an observed probability value equal to or less than 0.05, corrected for the number of contrasts tested for that matching variable.

It is important to note a criterion that was *not* included in the specification of our matching hypotheses. We did not require that the matching prediction specify the directionality of the individual slopes; rather the requirement was that the *difference* in slopes be consistent with theory-based expectations.

This decision was based on the absence of an untreated control group in Project MATCH. Thus, we were unable to tell whether a given client attribute would have prognostic value in the absence of treatment. Without this knowledge, we would be unable to say whether a slope that was negative was an indication that the treatment-client attribute combination was having an adverse affect on drinking outcome as compared to no treatment. Thus, if the slope of the line is descending for clients higher on the attribute scale, the only meaningful comparison possible is relative to the slope of the line for the comparison treatment. If both are descending, then the slope with the lesser decline would still be considered a relative match for that treatment. It is theoretically possible that both treatments may have been mismatches for this set of clients relative to no treatment at all. It must therefore be remembered that throughout this volume we are examining only client attribute-treatment combinations relative to other combinations of the attribute with different treatments.

Matching Effects

If the observed attribute by treatment interaction met these two criteria (statistically significant different slopes in a specified direction), then we tested whether the observed interaction had any clinical significance. An interaction that also had clinical significance was deemed a "matching effect". Clinical significance was asserted when we could identify one or more intervals along the client attribute axis in which we were at least 95-percent confident that a client having an attribute score within this interval would have an average drinking outcome superior to the contrasting treatment condition.

However, in order for the effect to be a matching effect it was also required that not all clients assigned to the one treatment condition would have better outcomes than if assigned to the other condition. In other words, at some point along the client attribute continuum, the two

slopes also had to either cross or be close enough to each other that we could not be 95-percent confident that clients with attribute scores at this point would have different drinking outcomes. If this latter criterion were not met, then we did not designate the attribute-treatment interaction to be a matching effect.

Clinical Versus Theoretical Value

In one respect, the criterion of clinical usefulness sets a higher standard for results to be judged of value than does the criterion of theoretical importance. For a client-treatment interaction to be clinically useful, it is not only necessary that attribute-treatment interactions be found, it is also minimally necessary that one subset of clients, but not another, be identified for whom the likelihood of a good outcome is enhanced by assignment to one or another treatment. The amount of clinical improvement resulting from differential treatment assignment is indicative of the clinical value to be attached to the matching effect. If the outcomes of a large number of clients could be enhanced, this result translates into clinical usefulness. Similarly, if the treatment outcomes of a smaller number of clients would be greatly improved by matching, this also would have greater clinical significance.

In contrast, for an attribute-treatment interaction to be theoretically interesting, it is only necessary that the slopes of the contrasting treatment by attribute lines be statistically significantly different from one another. This would include the case in which there was no matching effect discerned, even though there was a statistically significant interaction. This possible scenario is illustrated in figure 3, where it can be seen that at no level of the matching variable was the one treatment less effective than the other, yet an attribute-treatment interaction was observed, nested within a main effect of treatment.

Thus, it is not even necessary that the interaction account for clinically meaningful variance; what is important is that a lawful relationship has been established.

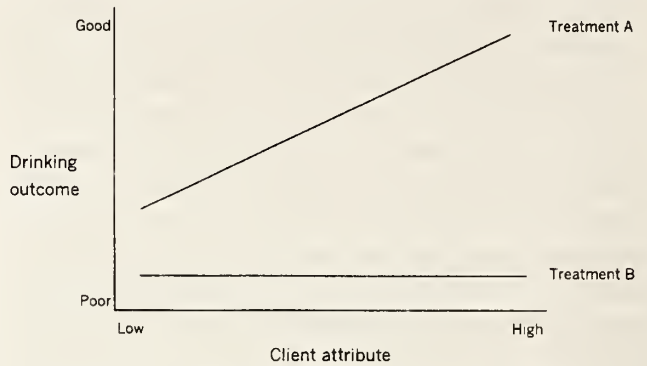

Figure 3. A client-treatment interaction without a matching effect.

If a client attribute-treatment interaction is statistically significant, but we are unable to identify the mechanisms producing this interaction, two effects result. First, it undermines the credibility of the effect, that is, was the relationship observed by chance or because of a lawful relation that exists between the variables. In other words, is it really true? Second, it also substantially limits the information available when attempting to replicate and/or generalize the effect with new populations. The scientific aim is to identify the set of conditions under which a client attribute-treatment interaction occurs, irrespective of whether a clinically important matching effect is observed.

Data Analysis

A Design Committee[1] was constituted for developing the plan for data analysis. Upon completion, the Project MATCH data analysis plan consisted of six major phases: (1) a preliminary phase in which descriptive and other analyses were performed to provide an overview of the data and to test assumptions for the main hypothesis tests; (2) confirmatory testing of the primary a priori matching hypotheses; supplementary analyses addressing (3) the secondary a priori matching hypotheses and (4)

[1] Design Committee members included Joseph Carbonari, Fran Del Boca, Mark Litt, Richard Longabaugh, Larry Muenz, Robert Rychtarik, Robert Stout (Chair), Scott Tonigan, and Philip Wirtz.

alternative analytical approaches for testing matches; (5) analyses directed at major issues other than patient-treatment matching; and (6) exploratory analyses aimed at detecting matching that was not predicted a priori. As the focus of this monograph is testing the a priori matching hypotheses, only the first four of these phases is reviewed.

Preliminary Analyses

Extensive analyses were performed to provide an overview of the data and test assumptions for the main hypothesis tests. Of primary concern at this stage were:

- Compliance
- Missing data
- Psychometric and distributional properties of variables that were critical to the primary objectives of the trial
- The effectiveness of urn randomization in producing equivalent treatment groups
- Detection of any site-based effects
- The relationships among the matching factors and among the primary dependent measures
- Assessment of the adequacy of the potential covariate candidates.

A number of key decisions resulted from these preliminary analyses. The distributional properties of the primary outcome variables suggested the need for an arcsin transformation of the frequency measure (percentage of days abstinent) and for a square root transformation of the intensity measure (drinks per drinking day). The two key outcome variables were found to be moderately correlated, but enough differences were found to merit separate analysis of each of them in the main analytical phase of the trial. Based on extensive analysis of missing data patterns, a "two-thirds" rule was adopted for aggregating daily data into summary weekly and monthly outcome indices, such that an individual's outcome indicators were recorded as "missing" on any week (during treatment) or month (following treatment) in which less than two-thirds of the drinking data were available for that individual.

Testing the Matching Hypothesis

For the two principal classes of a priori hypotheses addressed in Project MATCH (primary and secondary matching hypotheses), individual differences in response to alcohol treatment were modeled as a latent growth process (see, for example, Bryk and Raudenbush 1992; Laird and Ware 1982; Goldstein 1986; Strenio et al. 1983). Conceptually, this is roughly equivalent to creating a separate plot for each subject, with up to 12 points plotted (one for each followup period where data are available for the individual subject), with the outcome variable on the vertical axis and time on the horizontal axis. For each subject, a smooth curve (a latent growth curve) is then fit to these data so as to come as close as possible to the plotted points. Depending on investigator-specified constraints, this curve can be as simple as a straight line or as complex as an n^{th} order polynomial and is of the same level of complexity for all subjects.

Review of the matching hypotheses led to the decision that testing for quadratic polynomials would be sufficient. First, it could be argued that a matching effect would result from treatment that would persist in strength across the one year of posttreatment followup. Certainly this would be the hope of clinical investigators. On the other hand, given the oftentimes observed short-lived main effects of treatment, it was also quite plausible that matching effects present at the completion of treatment might subside with increasing time from treatment.

Still a third possibility considered was that matching effects might take time to emerge after treatment. This would be especially likely if ceiling effects were operative at treatment completion because all clients were doing very well. Only with time at risk from treatment completion would the differential effects of matching emerge. Finally, it was conceived as possible that it might take time for an effect to emerge, but that this effect would dissipate with longer intervals from treatment completion. A quadratic time variable would capture any of these possible scenarios. No greater levels of complexity were considered to be interpretable.

A further decision was made to split the period of observation into two distinct periods, within treatment and posttreatment. The primary window of observation was the period following scheduled treatment completion. (Treatment was scheduled to occur over 12 weeks). The Steering Committee believed that the posttreatment window was by far the most important time to consider. A matching effect that did not persist after the completion of treatment was considered to have little practical importance. Thus, the primary outcome period was the posttreatment period extending from the beginning of month 4 to the end of month 15. However, within-treatment matching effects were also to be investigated for their theoretical importance. If it were to be found that a matching effect occurred during treatment, this would support the theoretical rationale underlying the matching prediction, even though the observed matching effect would not substantially help clients.

It is interesting to note that this emphasis on posttreatment effects is not shared in randomized clinical trials of pharmacotherapeutic effects. In such studies, the end point for analysis is usually when the client is taken off the medication. For a parallel analysis in psychosocial treatment studies, the end point would also be at the completion of the therapy administration. Pharmacotherapy studies are more likely to focus on efficacy whereas psychosocial treatment outcome studies have traditionally focused more on effectiveness.

Model Parameters

The data analysis plan had no provision for systematically testing for nonlinear interaction effects between treatment modality and client attribute. This was because none of the matching hypotheses to be tested anticipated nonlinear matching effects. However, such relationships are not inconceivable. For example, it could be hypothesized that CBT would be more effective with clients who had moderate social skills than with clients who had either very good social skills or were markedly deficient. Those with extreme skills deficits might be unable to benefit sufficiently from social skills acquisition, whereas those with exceptionally good skills would not be in need of any further skills acquisition.

In contrast, TSF might be especially beneficial both for clients with especially poor social and exceptionally good social skills. Those with poor social skills might benefit from the group support offered to AA members, irrespective of their coping skills. Those with exceptionally good social skills might attain high status within AA because of these skills, which would help them to serve as role models for those less fortunate. These two nonlinear functions between a social skills matching variable and CBT and social skills and TSF could produce a nonlinear matching effect.

Some of the matching hypothesis teams did give consideration to the possibility of nonlinear matching effects, but it was decided that adding this complexity to an already seemingly very complex data analysis plan was unnecessary. Consequently, no comprehensive test of nonlinear matching effects was ever conducted, although some of the individual matching hypothesis teams did conduct exploratory analyses for such effects when linear matching effects were not observed.

For each matching hypothesis, each analysis was conducted twice (once for each of the two principal dependent measures) in each arm (outpatient, aftercare) and for each time period (within treatment and posttreatment) using the PROC MIXED procedure in SAS. In each analysis, the intercept, time, and time squared terms were entered as random factors in a linear model which also included the baseline value of the outcome variable, the matching variable, the treatment variable, the matching-by-treatment interaction, and the interactions of each of these with time and with time squared.

Analyses involving these time effects were centered at the midpoint of the associated period (within treatment, posttreatment) for two reasons. First, midpoint centering can reduce the implicit colinearity between an interaction term and the constituent variables of which it is a product (see Aiken and West 1991), thereby improving the power of the design to identify matching effects when they exist. Second, centering facilitates the interpretation of any significant attribute-treatment interaction which

does not change across time. Specifically, when time is centered at the midpoint of the period under investigation (and in the absence of a significant interaction of linear or quadratic time with the attribute-treatment effect), the coefficient of a significant attribute-treatment interaction represents the difference in slopes at the midpoint of the period.

Analyses involving discrete matching variables (e.g., gender, typology) were conducted in a manner similar to those associated with continuous matching variables, although the interpretation of the results varied slightly. Instead of focusing on between-treatment differences in the *slope* of the relationship between the dependent variable and the (continuous) matching variable, these analyses focused on between-treatment differences in the *mean* of the dependent variable at the two levels of the matching variable. Thus, the question became, for example, whether the difference in mean outcome between two treatments varied as a function of gender (possibly in interaction with linear or quadratic time). Similar to the analyses involving continuous matching variables, the hypotheses associated with the discrete matching variables were tested using Bonferroni-adjusted a priori directional contrasts.

Two sets of covariates were examined. The first set included the baseline value of the criterion drinking measure and its interaction with time. The second added a site-effect term. The objective of these analyses with the site-effect term added was to minimize the possibility that any discovered interactions were merely spurious reflections of differences between sites (i.e., to control for one potential source of internal invalidity). Conducting the analysis both ways—with and without the site in the model—was intended to facilitate discovery of hypothesized interaction relationships while at the same time allowing any such discovered relationships to be conservatively interpreted if they dissipated as a result of including site in the model.

Formal Testing Procedure

Each of the primary and secondary matching hypotheses was formally tested using a series of hypothesis-specific directional contrasts. Of primary interest was whether a given contrast was statistically significant (in the hypothesized direction), either by itself (directionally) or in interaction with the linear or quadratic time terms (nondirectionally). Contrasts for which a significant linear time and/or quadratic term appeared were then subjected to further testing on a month-by-month (posttreatment) or week-by-week (within treatment) basis in order to more adequately capture the timing of the increasing or decreasing matching effect. For any matching effect that interacted with time, each individual period was tested to judge whether the matching effect was present during that period. For examining these changing matching effects, $p<.05$ was judged to be a sufficient criterion for deciding whether matching was present within that single time period.

Although in theory only three data points are needed to estimate the parameters of any individual's latent growth curve under a quadratic polynomial specification, additional data points provide a much better assessment of the validity of the polynomial specification selected and of the error terms employed in the statistical tests. The flexibility offered by the Time Line Follow-Back procedure (Miller and Del Boca 1994) for assessing drinking behavior provided Project MATCH investigators with the opportunity to analyze drinking behavior across any time interval desired (including daily, if warranted). Recognizing that computational restrictions prohibited latent growth analysis of daily data across an 18-month period, 12 summary data points were felt to be sufficient to capture the essence of an individual's drinking behavior. For this reason, the latent growth analyses were based on the 12 *weekly* assessments of each participant's drinking behavior *during* treatment and on the 12 *monthly* assessments of each participant's drinking behavior *following* treatment.

For the a priori matching analyses, there was concern that strict application of a Bonferroni adjustment (accounting for both the primary and the secondary hypotheses)—including all of the hypotheses, two outcome variables per hypothesis, and multiple contrasts within some of the hypotheses—would result in an excessively conservative cutoff level that would unduly enhance the likelihood of a type 2 error. Since the

matching hypotheses were conceived of as conceptually independent of one another, it was decided to apply a trialwide Bonferroni correction to tests of significance within each hypothesis family, taking into account the two outcome variables and the number of proposed contrasts for that hypothesis, irrespective of whether the matching hypothesis was considered to be primary or secondary. If, for example, there were three hypotheses relating to a single matching variable, then those hypotheses were tested at a Bonferroni-corrected alpha level of 0.05/3. Because there were two dependent variables, the alpha level was further corrected by a factor of 2.

Latent Growth Analysis Versus Fixed-Effects MANOVA

At the time that Project MATCH was being designed, latent growth modeling (LGM) was largely unknown in alcohol research, although it was in widespread use in certain social science disciplines (notably educational psychology). The decision was made to focus on this analytical technique as the primary methodology for several reasons. First, there is extensive evidence of idiographic patterns of drinking among those dependent upon alcohol, and LGM permits individuals to manifest their unique patterns (within the confines of the selected polynomial form). Second, unlike classical general linear model formulations, LGM permits individual variation across time to be modeled as a random (rather than fixed) effect, thereby providing (1) estimation of the extent of between-individual variation across time and, as a result, (2) better estimation of the interaction effects and the error terms which form the basis for the statistical tests. Third, unlike multivariate formulations of the general linear model, individual subjects are permitted to have missing data at one or more time points and still be included in the analysis.

For these reasons, LGM was selected as the primary analytical approach for testing the Project MATCH primary and secondary matching hypotheses. However, because latent growth modeling was relatively new to the alcohol field, all major analyses were conducted a second time using the more widely understood fixed-effects general linear modeling procedure. Results of the two approaches consistently converged, with small differences due primarily to the differential assumptions, the slightly different sample size (classical general linear modeling requires no missing data), and cross-client variance in parameters.

In summary, the data analysis plan was quite elegant and appeared well suited to the hypotheses that it was developed to test. If matching was an active process in treatment, it seemed likely that this powerful design was well equipped to identify these effects, at least within the scope of possible effects envisioned.

Acknowledgments

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Causal Chain Analysis

Richard Longabaugh, Ed.D., and Philip W. Wirtz, Ph.D.

ABSTRACT

The analytic strategies used to assess the theories underlying the a priori matching hypotheses share a core element in that they all employ a "causal chain analysis" to test their underlying theory. The aim of causal chain analysis is to identify the influence of the variables thought to mediate the effects of treatment on client outcomes. Thus, causal chain analysis is mediator analysis applied to understanding how treatment works. When the search for mediators is applied to treatment outcome studies, it involves subsets of potential variables that are descriptive of treatment and of client response to treatment. This chapter describes mediation analysis and its application to testing mediation of interaction effects. Three models for testing are identified and matching hypotheses are classified according to which models they employed in each causal chain analysis. A typology for classifying results of testing the matching hypotheses in subsequent chapters is offered. This typology includes the paradoxical result of finding a supportive causal chain in the absence of a matching effect.

The purposes of the causal chain analyses presented in this volume are to (1) provide further information that would either support the observed matching effect or challenge its credibility and (2) identify the variables contributing to an observed interaction or discover why the hypothesized attribute-treatment interaction did not occur. Thus, where matching hypotheses are supported, the aim of the causal chain analysis is to identify the process through which the interaction occurs. Delineation of the causal mechanism increases the credibility of the interaction, and the active ingredients of treatment so identified can be exported to other treatment interventions. When an attribute-treatment interaction hypothesis is not supported, the causal chain analysis permits identification of the source or sources of its failure, revealing unsupported assumptions about treatment processes.

Mediators Versus Moderators

By definition, a "mediated relationship" is one which is "dependent on, acting by, or connected through some intervening agency" (Webster's 1986). In its simplest form, if variable A (e.g., treatment modality) affects variable C (drinking outcome) indirectly (through the effect of variable A on variable B [e.g., treatment structure] and the consequent effect of variable B on variable C), then variable B (structure) is

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said to mediate the relationship between variables A (treatment modality) and C (drinking outcome). The term "mediator analysis" defines the formal process of empirically testing whether, for example, B mediates (or explains) the relationship between A and C.

The term "moderator" is intended to convey a quite different—but also in matching studies, quite important—phenomenon. Generically, if the magnitude of the relationship between variable A and variable C differs depending on the level of variable B, then B is said to moderate the relationship between A and C. If, for example, the effect of treatment (variable A) on percentage of days abstinent (variable C) differs depending on the level of anger manifested by the client at baseline (variable B), then anger is said to moderate the relationship between treatment and percentage of days abstinent.

The conjunction of mediators and moderators lies at the heart of the Project MATCH causal chain analysis. The matching hypotheses each represented a hypothesized moderator relationship. *The objective of the causal chain analysis was, for each such hypothesis, to scrutinize the logic underlying the purported moderator relationship, that is, to test the purported mediators of each hypothesized moderator relationship (i.e., each of the matching hypotheses).* In so doing, it is possible to both determine if the matching effects observed experimentally were supported for the hypothesized reasons and locate the locus of the failure in the causal chains of those matching hypotheses which were not supported.

In general, there are three common analytical approaches:

- An informal comparison of treatment-group slopes
- A formal test using the general linear model
- A formal test using a structural equation modeling approach

All three approaches involve comparing the models which include a purported mediator to models which do not include the purported mediator; the approaches differ in the rigor with which mediation can be tested and in the comprehensiveness of the underlying model.

The informal approach, which involves comparing the significance level of the attribute-by-treatment interaction before versus after controlling for one or more purported mediators, is the simplest to perform but provides no formal basis for concluding that mediation has occurred. The general linear model approach is elegantly suited to causal models characterized by a single attribute-by-treatment of interest; most of the Project MATCH hypotheses fall into this category. A structural modeling approach, which involves comparing constrained to unconstrained models, is ideal when testing for the simultaneous effect of several mediators (although it can be employed in simpler models as well).

Testing Mediation of Treatment Main Effects

Although Project MATCH focused on interaction effects, it is instructive to understand the procedure for testing mediation of main effects before attempting to broaden the scope to the more complex models involving mediation of interaction effects. Readers already familiar with the formal testing for mediation of main effects may safely skip this section.

Irrespective of the analytic strategy developed for testing mediation, the conceptual model for a full causal chain analysis involves the following steps (figure 1).

First, a defined treatment needs to be discriminated from a comparison treatment on the basis of measured treatment ingredients (link 1 in the diagram). For example, it may be hypothesized and observed that Twelve Step Facilitation (TSF) and Motivational Enhancement Therapy (MET) differ from one another in their emphasis on abstinence as a goal for treatment.

Second, this identified difference in treatment is related to a difference in client response to treatment. For example, clients receiving an abstinence focus are observed to achieve greater posttreatment abstinence than those receiving less of an abstinence focus (link 2 in the causal

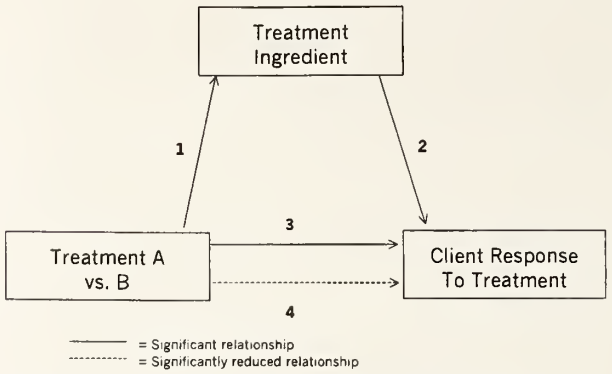

Figure 1. A generic causal chain analysis

chain). If it were also found that TSF was more effective than MET in producing client abstinence (link 3), then the next step in the causal chain analysis would be to examine whether the focus on abstinence accounts in whole, or in part, for TSF's incremental effectiveness (link 4). This would be demonstrated if it were observed that the significance of the main effect of TSF versus MET on abstinence was significantly reduced when the effect of focus on abstinence was partialed out from the relationship of treatment modality to client drinking outcome.

While this evidence is necessary for strong support for mediation, it is not sufficient evidence for causation. This is so because the entire causal chain analysis is conducted through an analysis of *associations* among the identified variables. The only variable that has been experimentally manipulated is treatment assignment. For unequivocal evidence of mediation, it would be necessary to experimentally manipulate each variable intervening between treatment assignment and drinking outcome to show that each in turn was dependent (or partially dependent) upon its predecessor in the causal chain. Such experimental manipulations cannot ordinarily be done in typical treatment outcome studies in which it is practical to manipulate only one variable, assignment to treatment condition. In a similar vein, some client variables of interest (age, gender, etc.) cannot be experimentally varied.

The case for causation can be strengthened by examination of competing mediator variable candidates. For maximum credibility, it is necessary to demonstrate that the identified mediating effect persists even after the effects of competing candidate variables have been removed. In our TSF versus MET example, this could be done analytically by showing that the mediator effects of focus on abstinence on the relationship between treatment and abstinence persisted even after the effects of competing candidates for mediation were removed. Because mediator analysis is correlational, and not experimental, the disciplined researcher can only conclude that the results obtained are consistent with the hypothesized mediation and the hypothesis has not been refuted.

Causal chain analyses in alcohol treatment outcome studies may quickly become complex, especially when a broad spectrum treatment such as Cognitive-Behavioral Therapy (CBT) is considered. CBT is often theorized to work indirectly to improve a client's drinking outcome (Longabaugh and Morgenstern 2000; Morgenstern and Longabaugh 2000). For example, CBT is intended to involve more time devoted to skills training than does MET and is expected to be predictive of differences in coping skills between CBT and MET clients at treatment completion. It is further hypothesized that improved coping skills will result in reduced drinking. Thus, for mediator analysis to support the theory, the causal chain analysis must test the links between: (1) treatment modality (CBT versus MET) and focus on skills training, (2) skills training and end of treatment improvement in client skills, and (3) improvement in client skills and drinking outcome. If it were found that (4) CBT was more effective than MET in reducing client drinking posttreatment, it would be necessary to show that (5) this greater effectiveness could be attributable to the causal chain, that is, when the effects of the linkages involved in the causal chain are removed from the relationship of treatment to drinking, this relationship is significantly reduced (figure 2). Finally, the evidence for mediation is strengthened if it can be shown that the mediated effect persists after ruling out alternative candidates for mediation, for example, the number of treatment sessions received in CBT versus MET.

Another complexity that frequently arises in causal chain analysis of treatment outcomes occurs because treatment effects are measured at

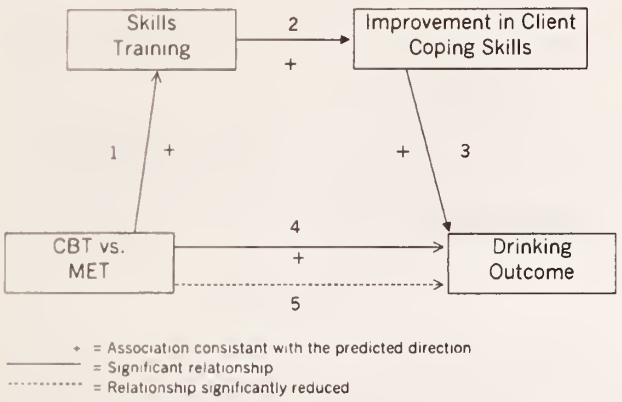

Figure 2. A hypothetical mediation analysis: CBT versus MET

intervals distally removed from the end of treatment, for example, clients are assessed a year after treatment completion. To be credible, a theory of treatment effectiveness is likely to postulate and test that client changes at the end of treatment are predictive of longer term drinking outcomes. Thus, the causal chain sequence specifies that assignment to alternative treatments leads to end-of-treatment differences in clients, themselves predictive of longer term drinking outcomes. In the TSF versus MET example described above, the causal chain would predict that the abstinence achieved by the client by the end of treatment would be predictive of reduced drinking during the year following treatment.

Not necessary for testing mediation, but highly desirable for demonstrating the generalizability of the mediator effects, would be demonstration that the effects of the putative mediator variable could be replicated in a new population. In Project MATCH, this opportunity was seemingly provided by the conduct of two independent studies—the aftercare treatment arm and the outpatient treatment arm. If it could be shown that the same mediator variables were operative in both arms of the study despite the difference in client populations and treatment context (i.e., standalone outpatient treatment versus aftercare following a more intensive inpatient or partial hospital experience), this would strongly support the belief that the mediator effects could be generalized across a broad spectrum of treatment settings.

Testing Mediation of Interaction Effects

While this approach has been widely adopted for testing simple mediation hypotheses, the formal test of a matching causal chain is one level more sophisticated, in that it requires testing for mediation of a *moderator* (i.e., interaction) effect rather than of *main* effect. The additional challenge imposed by a matching hypothesis is further heightened under a structural equation modeling approach, where detection of interactions involving latent constructs has proven particularly daunting.

When testing for a causal chain underlying main effects, it is necessary to show that the treatments compared differ in their implementation, for example, there was greater emphasis on an abstinence goal in TSF than in MET. When testing for causal chains to explain interactions, there is no single analogous step. Rather, for the causal chain to be supported, it is necessary that an interaction be observed in at least one step of the causal chain analysis and that the other links in the chain (which may involve either main or interaction effects) are also sustained.

Canonical Models

We describe three basic models which we believe are sufficient to account for the ways in which a causal chain can support a hypothesized client attribute-treatment interaction. Each of the models can be (and is in the following chapters) elaborated to involve considerably more complex causal chains. Nevertheless, at core they can be reduced to one of these three generic models, which we will refer to as canonical models. It should be emphasized that the value of distinguishing between canonical models is primarily descriptive.

Canonical Model 1

An element of the treatment process interacts with the client attribute.

The first model hypothesizes that treatments will differ in delivery of a specified treatment ingredient (figure 3). For example, TSF is hypothesized to have a greater focus on abstinence as a

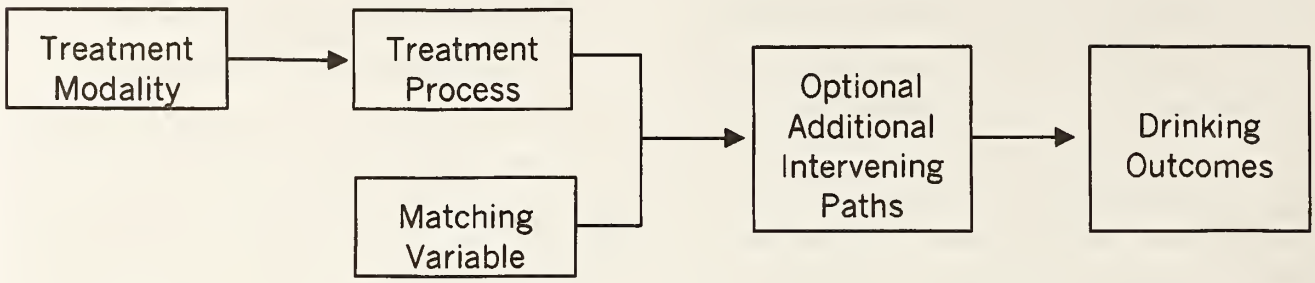

Figure 3. Canonical Model 1

treatment goal than is CBT. To test this hypothesis, a measure of emphasis on abstinence is included in the causal chain to be tested. This difference in focus on abstinence is hypothesized to interact with a client attribute, alcohol dependence, called the matching variable, so that a differential drinking outcome is observed as a function of the interaction of emphasis on abstinence. Clients with greater alcohol dependence benefit more from an emphasis on abstinence than clients with less alcohol dependence. Because TSF has a greater emphasis on abstinence than CBT, it is expected that TSF will be more effective with clients having greater alcohol dependence. Because CBT has a lesser focus on abstinence, it is expected that CBT will be more effective with clients with less alcohol dependence. In order for this causal chain to support an observed alcohol dependence by TSF versus CBT treatment interaction, at least three steps are necessary.

First, it needs to be established that TSF did involve a greater focus on an abstinence goal than CBT. Second, the *amount* of a client's dependence must be shown to interact with focus on abstinence to affect drinking outcomes, such that those with higher dependence had better drinking outcomes when their treatment had a greater emphasis on abstinence and/or that clients with low dependence had better drinking outcomes when their treatment had a lesser focus on abstinence. Third, it is necessary to demonstrate that this abstinence emphasis-dependence interaction accounted for the observed treatment modality-dependence interaction by showing that the significance of the latter interaction is significantly reduced when the effect of the former interaction is removed. Several of the hypothesized causal chains were predicated on this canonical model.

Canonical Model 2

The client matching variable produces a behavior which interacts differentially with treatment.

A second causal model (figure 4) hypothesizes that a client matching variable will lead to a certain kind of client behavior in treatment. This client behavior will interact with treatment modality to affect client outcome. MATCH hypothesized that clients differing in their anger prior to treatment would differ in their resistance to treatment, in that high anger clients would respond with greater resistance to treatment than would clients with low anger. To test this causal chain, indices of client resistance in treatment needed to be operationalized.

The next link in the causal chain was the hypothesis that this client resistance would interact with the type of treatment received, so that high anger clients assigned to MET would show less resistant behaviors than would high anger clients in CBT/TSF. The differential resistance to treatment would in turn result in different drinking outcomes, with those less resistant to treatment having better drinking outcomes than those more resistant.

In order for this causal chain to be supportive of an observed treatment modality-client attribute interaction, it is first necessary to show that clients high in anger differ from those low in anger in their behavioral resistance. Then, it is necessary to show an interaction of resistance with treatment modality such that high resistance clients in MET show greater reductions in drinking severity than do clients in any of the other treatment conditions. Finally, it is

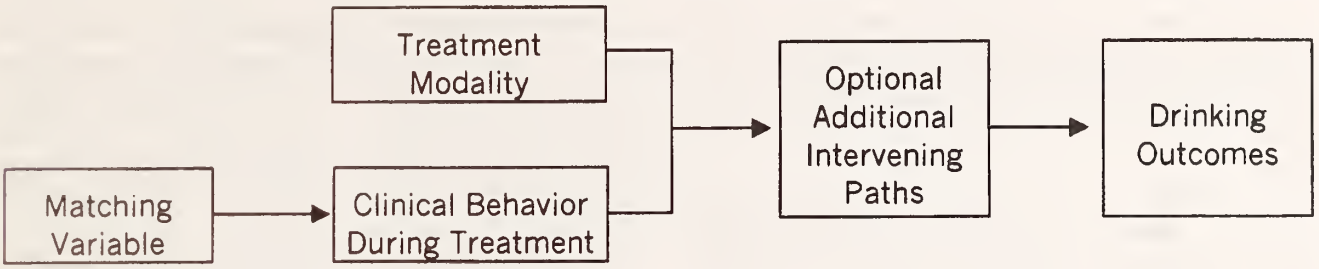

Figure 4. Canonical Model 2

necessary to show that the observed relationship between the combination of treatment modality-client anger and drinking outcome is significantly reduced when the effect of the treatment modality-client resistance interaction is removed.

Canonical Model 3A

Treatment modality interacts with a client matching variable to affect an intervening variable that is predictive of drinking outcome.

A third model postulates that a hypothesized treatment modality-client attribute interaction leads to a measured client response that in turn is predictive of drinking outcome (figure 5). For example, it was hypothesized that TSF would lead to greater AA participation by high meaning-seeking clients (but not by low meaning seekers) than would MET or CBT. AA participation in turn was expected to be predictive of better drinking outcomes. In this model, the combination of treatment modality and client attribute leads the client to engage in behavior otherwise unpredictable from treatment modality or client attribute by themselves. This changed behavior is in turn related to drinking outcome.

To test this causal chain, AA participation would be regressed on the product term of TSF versus MET and/or CBT by meaning seeking, and the product term would be observed to account for variance in AA participation over and above that accounted for by the two main effect variables, treatment assignment and meaning seeking. To validate the chain, AA participation would have to be shown predictive of drinking outcome. Finally, by partialing out the effect of AA participation on the initial meaning seeking by treatment assignment interaction, it would be expected that the latter effect would be significantly reduced.

Canonical Model 3B

The client matching variable modifies the delivery of the treatment modality to affect an intervening variable that is predictive of drinking outcome.

While it could be reasonably expected that one or the other of the three models described so far should be at the core of all of the causal chains hypothesized and tested, a second variation of Model 3 emerges. In this model, it is hypothesized that the client matching attribute will modify one of the treatments, such that the treatment actually changes as a function of the

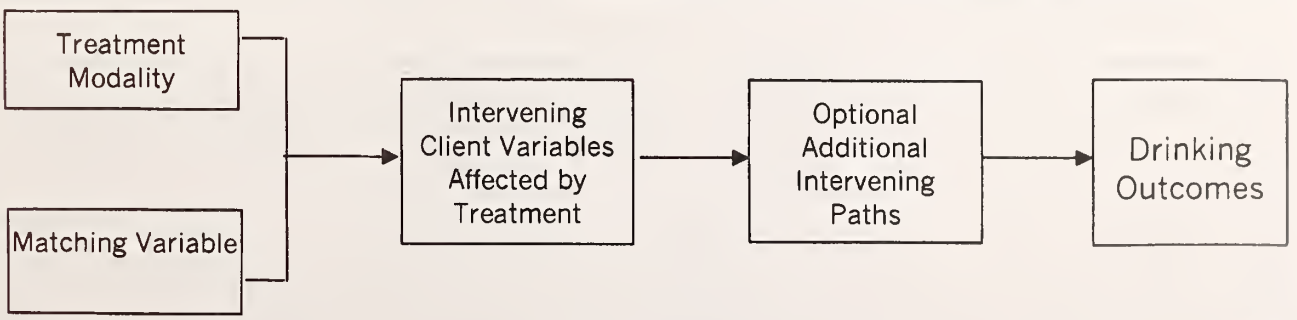

Figure 5. Canonical Model 3A. Treatment modality interacting with client matching variable to affect an intervening variable predictive of drinking outcome.

client attribute. This interaction of client attribute and treatment modality is predictive of a subsequent client behavior, which itself is associated with subsequent drinking outcome (figure 6).

As treatments are intended to be standardized across clients and delivered uniformly irrespective of client attributes, causal chain data supporting such a model would appear to challenge the integrity of the three treatments. However, this is not necessarily so, as there is room for such variability explicitly built into the CBT manual. The CBT treatment manual prescribes the delivery of eight core modules, but after completion of these modules, there is the option to select further modules from a menu of alternatives available. Thus, once the core sessions have been completed, the client and therapist can select from the remaining modules, the selection being dependent upon client choice or need. For example, a client might or might not be exposed to a mood management module.

In MATCH, it was hypothesized that CBT would be more effective then either TSF or MET for clients with greater psychopathology because CBT would provide high psychopathology clients with a greater exposure to treatment ingredients that reduce psychopathology. It was expected that this intervention would lead to a greater reduction in drinking than it would for low psychopathology clients.

In this scenario, CBT could be demonstrated to be different from the comparison treatment when delivered to a subset of clients, though not necessarily all (i.e., there would be an interaction observed in this first step of the causal chain). For example, if the mood management module in CBT was selected more often for (or by) high psychopathology clients, then this group would actually receive a somewhat greater exposure to CBT than would low psychopathology clients. Consequently, the CBT treatment for high psychopathology clients would differ from the CBT treatment provided for low psychopathology clients as a function of the psychopathology matching variable. This would establish a differential treatment experience for the subset of clients for whom it was hypothesized that CBT would be more effective. For this reason, it might be expected that a treatment-modality-by-client-attribute interaction would arise as a consequence of the matching variable affecting the treatment delivered. (This is in contrast to Model 1 in which the standard delivery of the treatment has a differential effect on clients varying in the matching variable.) If it were then shown that: (1) focus on mood management was predictive of reduced psychopathology for either all clients or just those psychopathologically impaired and (2) improved mood management was associated with better drinking outcomes either for all clients or just those psychopathologically impaired, this would provide evidence for the causal chain.

Summary

One or more of these canonical models are embedded in each of the hypothesized causal chains (table 1). Usually the causal chain is more complex and involves other linkages as well. In order for a causal chain to be supported, it is necessary that at least one interaction occur somewhere in the causal chain (which might be the original interaction affecting the mediator variable) and that connecting effects be carried

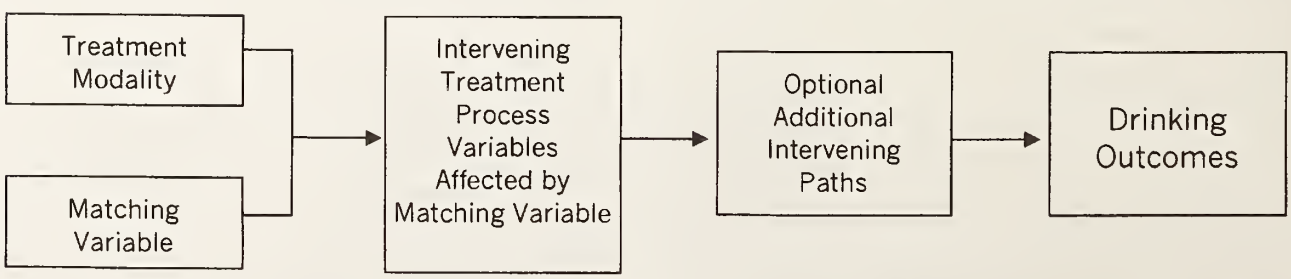

Figure 6. Canonical Model 3B. The client matching variable modifies the treatment modality to affect an intervening variable that is predictive of drinking outcome.

Table 1. Hypothesized mediator variables and Canonical Models for each causal chain

Matching variable	Hypothesized mediator	Canonical model*
Alcohol Dependence	Emphasis on abstinence	1
	AA involvement/Attendance	1
Alcohol Involvement	Within-Treatment Drinking	1&2
	Within-Treatment Self-Efficacy	1
	Negative Consequences of drinking	1
Cognitive Impairment	Amount of Therapy	1/3B
	Amount of Therapeutic structure	1
	AA involvement/Attendance in Treatment	1
Psychopathology and Psychiatric Severity	Emphasis on psychopathology	1/3A/3B
	Reduction in psychiatric symptoms	1/3A/3B
Sociopathy/ASPD	Amount of Therapeutic structure	1
	AA attendance	2
	Working Alliance	2
	Anger reduction	2,1
A versus B Typology	Amount of Therapeutic structure and cognitive change	1
	Working Alliance	3A
	Change in psychopathology	3A
Anger	Taking Steps	2
	Problem recognition	2
	Working Alliance	3
Conceptual Level	Amount of Therapeutic structure	1
Meaning Seeking	Working Alliance	3A
	Client satisfaction with Treatment	3A
	Percentage of Treatment sessions attended	3A
	AA involvement/attendance	3A
Religiosity	Working Alliance	3A
Interpersonal Dependency	Satisfaction with Treatment	3A,3A
	Percentage of Treatment sessions attended	3A,3A
Gender	Role Demands	1 & 2
	External Stresses	1 & 2
	Psychiatric severity	1 & 2
	Depression	1 & 2
	Self-esteem	1 & 2
Motivational Readiness	Working Alliance	3A
	Compliance	3A
	Change Processes	3A
	Increased Readiness to change	3A
	Self-efficacy for abstinence	3A
Problem Recognition	Working Alliance	3A
	Change in Problem Recognition	3A
Self-Efficacy	Change in Self-Efficacy	3A
Temptation minus Confidence	Change in Temptation minus Confidence	3A
Network Support for drinking	Coping with social pressure to drink	1
	Change in network support for drinking	1
	AA attendance	1
Prior AA	Working Alliance	3A
Social Functioning	Change in Social Functioning	3A

*Canonical models separated by a comma show that one model precedes the other in the causal chain. Models separated by an & were conceptualized as occurring simultaneously. A / between canonical classifications indicates that the mediational model allowed alternative canonical pathways through which the mediating effect could occur. Consensus classifications were made by the two authors on the basis of discussion following independent review and classification. Some causal chains may be misclassified due to a lack of total explicitness in their descriptions.

through the causal chain from treatment implementation to drinking outcome.

In the full causal chain underlying a matching hypothesis, differences in treatment delivery should not be assumed but should be tested. If this step is not conducted, one would not know if the lack of a differential client response is due to incorrect theory or if the clients in the treatments compared did not receive different doses of the putative active ingredients. Furthermore, some theories underlying the hypothesized client-treatment interactions make use of intervening client variables, such as increased motivation, as variables mediating the effect of treatment on drinking outcome. These need to be measured and their mediating influence tested as well. Finally, drinking outcomes are measured over one year following treatment completion. If a client-treatment interaction is observed to change over time (as some did), then the choice of time period for measuring drinking outcome becomes less obvious. As treatment effects have generally been found to be transient, the case can be made for measuring the drinking variable immediately following the end of treatment, rather than at a time further removed, when the effects of treatment may have been obscured by posttreatment events.

To conclude this section, we hypothesize that a moderating effect will be explained by a causal chain only when at least one of the connecting links in the causal chain involves an interaction and the remaining links involve either main effects or interactions. However, even if these conditions are met, only a complete test for mediation will establish whether the causal linkages are explanatory.

Paradoxical Findings

Under limited circumstances, causal chain linkages in the absence of client-treatment interactions may be observed. While the hypothesized client attribute-treatment modality interaction may not be detected, it may still be possible to find evidence for the causal chain developed to explain the expected but unobserved interaction. One explanation for this seemingly paradoxical finding is that different treatment modalities provide different pathways for clients with the same attribute to achieve equally good drinking outcomes.

A MATCH example may help to make this point clear (Kadden et al., this volume). It is hypothesized that CBT will be more helpful than TSF in reducing drinking for clients with antisocial personality disorders (ASPD). The logic behind this client-treatment modality interaction is as follows: ASPD clients are frequently lacking in coping skills. Drinking is their way of coping in situations where they lack the needed coping skills. Therefore, ASPD clients need training in coping to achieve their goals and avoid drinking. CBT trains clients to acquire and use these skills. When such skills are enacted instead of drinking, the ASPD client will have a good drinking outcome. Thus, the causal chain is: CBT involves coping skills training. Coping skills training leads to the acquisition of coping skills. Coping skills acquisition for ASPD clients will produce an interaction such that ASPD clients will have better drinking outcomes than non-ASPD clients.

Hypothetically, however, it could also have been hypothesized that TSF will be more helpful than CBT for ASPD clients, resulting from a different causal chain. TSF exhorts clients to attend AA. AA participation leads to better drinking outcomes. Generally, ASPD clients would be less likely to attend AA than non-ASPD clients. Nevertheless, because of the TSF emphasis on attending AA, more do so when assigned to TSF. ASPD clients are unlikely to receive acceptance and esteem from people in their natural social network because of the lack of consideration by the ASPD of the feelings and needs of others. However, in AA this behavior would not be cause for rejection because alcoholism is considered to be at the core of all such antisocial behaviors. The client may thus find acceptance in AA that would not be available outside of AA. This acceptance could lead to an increase in the ASPD client's concern and feelings for others. The reciprocated concern brings about increased self-esteem; the mutual concern increases social cohesiveness. The acceptance that ASPD clients find in AA, conditional upon their wanting to quit drinking, results in their increasing abstinence. In this scenario, TSF leads to AA participation, AA participation for the ASPD leads to greater

self-acceptance conditional upon sobriety, which in turn leads to better drinking outcomes.

Both of these causal chains could be equally operative—the former in CBT and the latter in TSF. However, if the only causal chain developed to support the hypothesized ASPD-treatment modality interaction was for CBT, the hypothesized client attribute-treatment interaction might not appear. This would not be because the underlying theory regarding the effect on drinking of ASPD client's acquiring coping skills was wrong, but because the causal chain underlying TSF's affect on ASPD clients was also right. In this scenario, TSF would have affected ASPD clients through an alternative (but unidentified) causal chain process that led to equally good drinking outcomes for ASPD clients treated in TSF. If this were the case, then a causal chain analysis could support coping skills training as a correlate of better drinking outcomes in CBT, despite the observation that the hypothesized interaction of CBT by ASPD did not materialize. Thus, ASPD clients would have equally good drinking outcomes in CBT and TSF, but for different reasons.

In such an event it would be instructive to reexamine the treatment modality initially believed to be inferior for clients with this attribute to assess whether an alternative causal chain was responsible for the unexpected effectiveness of the TSF treatment for the ASPD client. Such a discovery would not undermine the theory underlying the unobserved CBT–ASPD interaction, but it would provide one explanation as to why the interaction did not emerge. Such a discovery would be a considerable achievement for theories trying to explain treatment effectiveness.

A Classification Typology for MATCH Results

The joint examination of both attribute-treatment interaction effects and causal chain analysis leads to one of four outcomes (table 2).

First, in the best of circumstances, the hypothesized attribute-treatment interaction has occurred and a supporting causal chain has been identified. In this case, the theory underlying the matching hypothesis is supported and the credibility of the matching effect is strengthened. Not only are we able to explain why the treatment is especially effective for a defined client, we are also able to extract the identified treatment ingredient for incorporation into another treatment, hypothesizing that the active ingredient will increase the effectiveness for this type of client in this other treatment as well.

Table 2. A fourfold typology for classifying MATCH results

Matching hypothesis	Supporting causal chain	
	Identified	Not identified
Matching prediction supported	yes/yes	yes/no
Matching prediction not supported	no/yes	no/no

Second, it may be observed that the hypothesized attribute-treatment interaction has not occurred nor has the hypothesized causal chain been supported. In this circumstance the breakdown in the linkage in the causal chain will indicate whether the failure may be attributable to a failure in treatment implementation (e.g., where the treatments do not differ in their putative active ingredients) or a failure in the theory as to how treatment affects drinking (e.g., where the observed differences in treatments do not affect the clients as expected) (Finney and Moos 1992). Depending upon which of these is the case, future research may seek to strengthen the treatment or develop a better theory regarding treatment effects.

Third, it may be observed that the hypothesized attribute-treatment interaction has occurred, but the causal chain has not been supported, that is, the prediction is supported but not for the reasons we postulated. In this instance, the credibility of the observed interaction is undermined, with the belief that it may be the result of a type 1 error. Moreover, in terms of theory development, nothing has been added to the existing knowledge base. We may believe that we have produced an attribute-treatment interaction but we know not how. We are unable to

identify the active ingredients of treatment to be included in subsequent research.

Finally, it may be that a hypothesized attribute-treatment interaction does not occur even though the causal chain analysis suggests that it should have materialized. In this case, it is likely that alternative paths for reaching the same end are present in the comparison treatment but are unidentified. The next step for research would be to seek out these alternative pathways to better outcomes. This would permit the implementation of different treatment modalities with equal effectiveness by making within-modality adjustments to address the salient characteristics of these clients.

Acknowledgment

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Part II: Alcohol Dysfunction

Matching Clients to Alcoholism Treatment Based on Severity of Alcohol Dependence

The Alcohol Involvement Matching Hypothesis and Findings

Matching Clients to Alcoholism Treatment Based on Severity of Alcohol Dependence

Ned L. Cooney, Ph.D., Thomas F. Babor, Ph.D., and Mark D. Litt, Ph.D.

ABSTRACT

Several studies have reported significant matching effects based on individual differences in severity of alcohol dependence. An alcohol dependence matching hypothesis developed for Project MATCH predicted that clients who have greater alcohol dependence would have better outcomes following Twelve Step Facilitation (TSF) than following Cognitive-Behavioral Coping Skills Therapy (CBT) or Motivational Enhancement Therapy (MET), relative to clients who have less alcohol dependence. The CBT versus TSF matching contrast was supported in the aftercare arm. However, this matching contrast was not supported in the outpatient arm, and the MET versus TSF matching contrast was not supported in either arm. The significant aftercare CBT versus TSF matching effects were found in the year after treatment, and it is not known whether these matching effects were maintained beyond 1 year because the aftercare sites did not participate in the 3-year followups. Aftercare clients with severe dependence had better drinking outcomes (higher percentage of days abstinent (PDA) and lower drinks per drinking day (DDD)) when assigned to TSF, while those with low levels of dependence had better outcomes (higher PDA and lower DDD) when assigned to CBT. In a post hoc analysis, subjects in the aftercare sample were divided into groups; those with scores on the Ethanol Dependence Syndrome Scale less than or equal to 35 were classified low dependence, and those with scores greater than 35 were classified high dependence. Matched clients had a 10-percent higher success rate than mismatched clients and a 5-percent higher success rate than unmatched (randomly assigned) clients. These effects are not large, so clinicians should expect only modest gains from using this matching strategy. Process analyses supported the hypothesis that the alcohol dependence matching effect in the aftercare arm was mediated by differences in the degree of therapist emphasis on abstinence. Only partial support was found for the other causal chain hypothesis that Alcoholics Anonymous attendance mediated the dependence-treatment matching effect.

In part to address the perceived need for improved nomenclature, consistent classification criteria, and more objective measurement procedures, several investigators have postulated a construct termed the alcohol dependence syndrome (ADS). First introduced in a seminal paper by Edwards and Gross (1976), the construct was given its most formal description in 1977 by a group of investigators convened by the World Health Organization (Edwards et al. 1977) and has recently provided the conceptual underpinnings for the definition of dependence criteria in DSM–III–R (Rounsaville et al. 1986; American Psychiatric Association 1987), ICD–10 (World Health Organization 1992), and DSM–IV (American Psychiatric Association 1995).

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As an empirical clustering of cognitive, behavioral, and physiological phenomena, the ADS includes the following seven elements (Edwards and Gross 1976; Edwards et al. 1977):

- Narrowing of the drinking repertoire, that is, a tendency for the drinking pattern to become stereotyped around a regular schedule of almost continuous daily alcohol consumption.
- Increased salience of drink-seeking behavior, such that alcohol is given greater priority than its adverse consequences or inconveniences.
- Increased tolerance to alcohol, reflected in a capacity to sustain high levels of consumption and the need to drink more alcohol than previously to achieve a constant level of effect.
- Repeated withdrawal symptoms, including affective disturbance, tremor, nausea, and sweating.
- Relief or avoidance of withdrawal by further drinking.
- Subjective awareness of compulsion to drink, including such phenomena as craving for alcohol, impaired control of alcohol intake once drinking has commenced, and difficulty in abstaining from drinking.
- Rapid reinstatement of symptoms if drinking is resumed after a period of abstinence.

The last element is no longer considered as a diagnostic criterion because it describes a characteristic of the syndrome as a whole.

There is now good evidence from interview and questionnaire studies to show that the main components of dependence can be reliably assessed (Stockwell et al. 1983; Babor 1996) and that many of them cluster together to form a core syndrome (Edwards 1986; Babor, Lauerman, and Cooney 1987). Factor analytic studies have not only provided support for the construct validity of a single alcohol dependence factor (Kosten et al. 1987; Skinner and Allen 1982) but have also demonstrated that the construct has similar characteristics in alcoholic clients and heavy drinkers in different cultures (Babor, Lauerman, and Cooney 1987; Hall et al. 1993; Allen et al. 1993). Finally, one study has shown that dependence severity predicts the rapidity of reinstatement of dependence symptoms after a period of abstinence (Babor, Cooney, and Lauerman 1987).

Evidence for Matching

In addition to research on the construct validity and predictive utility of the ADS concept, several studies suggest that the severity of alcohol dependence may have implications for treatment matching. Polich and associates (1981), for example, looked at higher order interaction effects between alcohol dependence, marital status, age, and relapse to drinking at 18 months and 4 years after treatment. Older men with a high severity of dependence at admission to treatment had a lower risk of relapse if they abstained rather than engaged in nonproblem drinking at 18 months, regardless of marital status. The reverse was true for younger men with low dependence severity. But for older men with low dependence and younger men with high dependence, marital status played a moderating role. Those who were married had lower relapse rates if they abstained, whereas nonmarried men had lower relapse rates if they were nonproblem drinkers. Other studies have also shown that severity of dependence is a strong predictor of the alcoholic's ability to engage in nonproblem drinking over time (Sanchez-Craig et al. 1984; Foy et al. 1984; Taylor et al. 1986; Vaillant 1983).

Only a few studies have evaluated severity of dependence in relation to treatment in a randomized trial. Orford and colleagues (1976) concluded that clients who had been classified as severely dependent (i.e., gamma alcoholics) were more likely to have better 2-year outcomes if they had received treatment (outpatient plus inpatient) rather than one session of advice. Conversely, nongamma alcoholics fared better if they received advice rather than treatment. A 10-year followup study of these clients indicated that the better outcome of the more dependent clients was associated with more treatment and Alcoholics Anonymous (AA) involvement (Taylor et al. 1986). However, a more recent reanalysis of the 1-year outcomes of the Orford group's (1976) study found no evidence for a treatment-matching effect and called into question the

conclusions of the original report (Edwards and Taylor 1994).

Given these conflicting findings, there is reason to evaluate the alcohol dependence hypothesis in a more precise and systematic way. The original study by Orford and associates (1976) and the recent secondary analysis of the 1-year outcome data (Edwards and Taylor 1994) were based on measures of dependence and treatment outcome that were not designed to explore the treatment-matching implications of dependence. The matching hypothesis was tested in an entirely post hoc manner. It was based on a rather crude classification of clients as gamma and nongamma alcoholics, and the predictions dealt with the relationship between dependence and intensity of therapy, rather than dependence and type of treatment. Given these limitations, and the wide acceptance of the original findings, it seemed important to conduct a more systematic test of the dependence severity hypothesis in Project MATCH.

Statement of Hypothesis

This hypothesis is based on research and speculation suggesting that the alcohol dependence syndrome has important implications for treatment matching. It differs from the hypothesis on alcohol involvement discussed elsewhere in this volume in that the matching variable is more specific (alcohol dependence versus alcohol involvement) and the predicted interactions are different. For example, the alcohol involvement hypothesis predicted that Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992) and Twelve Step Facilitation (TSF; Nowinski et al. 1992) would have similar impacts on clients with higher dependence, while the present hypothesis predicted that these treatments would have a differential impact on clients as severity of dependence increased.

All a priori matching hypotheses in Project MATCH were specified as predictions that the slopes of the regression lines of the matching variable on the primary outcome variables would significantly differ across specified treatments. The hypotheses identified the directional nature of the difference in slopes, but they did not specify whether or where the regression lines intersected. Thus, the alcohol dependence matching hypothesis was specified as follows: *Clients who have greater alcohol dependence will have better outcomes following TSF than following CBT or Motivational Enhancement Therapy (MET; Miller et al. 1992), relative to clients who have less alcohol dependence.*

We tested this hypothesis as two a priori contrasts, one comparing TSF and CBT and the other comparing TSF and MET. As illustrated in figure 1, we predicted that the slope of the TSF regression line would be more positive than the slopes of the CBT or MET regression lines. No prediction was made regarding whether or where the regression lines intersect. The alpha level was divided evenly between the two contrasts.

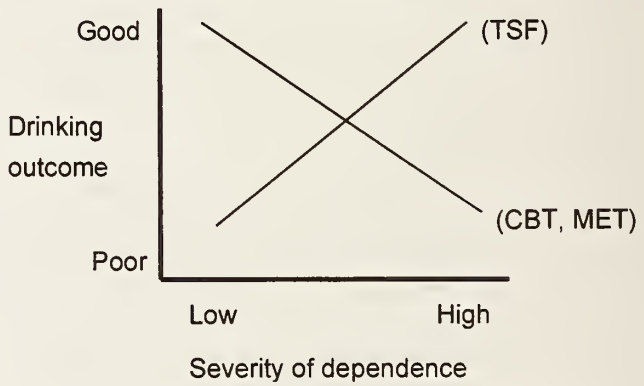

Figure 1. Predicted relationships between severity of dependence and drinking outcome for clients treated with TSF, CBT, and MET.

Measurement of Matching Variable

Matching Variable

Dependence severity was measured by means of the Ethanol Dependence Syndrome Scale (EDSS), a set of 16 self-report items developed and validated by Babor and colleagues (Hesselbrock et al. 1983; Hall et al. 1993; Babor 1996). This scale has been demonstrated to predict intensity of reinstatement of drinking among individuals who relapsed after inpatient treatment (Babor, Cooney, and Lauerman 1987). An analysis of the baseline Project MATCH data (Babor 1996) showed that the scale has a

normal distribution (skewness=0.35, n=1702) and good test-retest as well as internal consistency reliability (alpha=0.90, n=1543). The total dependence score on the EDSS is highly correlated with the Alcohol Use Inventory G scale (r= 0.69, n=1590).

Dependent Variables

The primary dependent measures used to evaluate the dependence hypothesis were drinks per drinking day (DDD) and percentage of days abstinent (PDA). These were derived from data obtained in Form 90 interviews (Miller and Del Boca 1994) scheduled every 3 months in the year following treatment. Data from these followups were also used to compute a composite outcome variable (Zweben and Cisler 1996) that was used as a secondary outcome measure.

Causal Chain Hypotheses

Two causal chain hypotheses were developed prior to examination of outcome data. The dependence-matching effect was thought to be mediated by (a) the degree of emphasis that the therapist placed on abstinence as a goal of treatment and (b) differences in the client's frequency of AA attendance. Figure 2 illustrates these hypothesized causal models.

The first causal chain hypothesis predicted a mediating role for the degree of emphasis that the therapist placed on abstinence as a goal. TSF therapists were expected to give a strong message to clients that complete abstinence is necessary because any alcohol consumption is likely to lead to loss of control; CBT and MET therapists were not expected to emphasize abstinence and loss of control as strongly or as explicitly. CBT provided explicit instruction in how to cope after a "lapse."

Highly dependent clients were expected to do poorly with CBT because their coping skills would be inadequate to deal with lapses. In these clients, a high level of dependence is thought to produce rapid reinstatement of dependence symptoms after the reinitiation of drinking. MET used an empathic, client-centered, gently persuasive approach to help clients who are ambivalent about abstinence to consider their options. Severely dependent clients were expected to do poorly with MET because it was thought they might attempt to pursue a moderate drinking goal or they may need more than client-generated strategies.

On the other hand, clients with mild dependence were expected to do well with CBT because they could effectively utilize the lapse-coping skills, and they would also do well with MET because they might have a reasonable chance of success if they chose a moderate drinking goal. In contrast, clients with low levels of dependence were expected to do poorly with TSF because the notion of loss of control that is strongly emphasized in AA would not be consistent with their personal experience of their own drinking history.

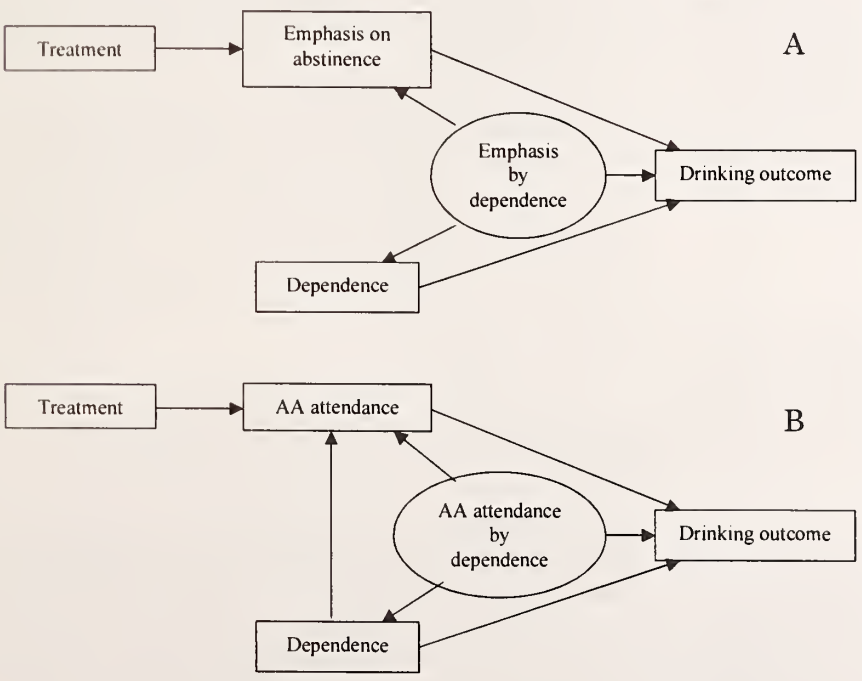

Figure 2. Hypothetical causal chains for matching based on alcohol dependence. (*A*) Causal chain in relation to therapist's emphasis on abstinence. (*B*) Causal chain in relation to AA attendance.

A second causal chain hypothesis predicted a mediating role for AA attendance. First, it was predicted that TSF would result in more AA meeting attendance across all types of clients compared with CBT or MET. Second, it was predicted that severely dependent clients would attend more AA meetings than mildly dependent clients. This prediction was based on the expectation that clients who attended AA meetings would be likely to receive the message that any drinking would result in loss of control. This loss of control message was expected to resonate in the highly dependent subjects because they have frequently experienced such loss of control. On the other hand, the loss of control message was expected to be dissonant to clients with mild dependence. The degree of concordance between the loss of control message and previous experience of clients was expected to affect AA meeting attendance.

Frequent AA attendance was expected to be associated with reduced drinking. However, to produce a matching effect, the impact of AA attendance on drinking should be different for clients with severe or mild dependence. Among severely dependent clients, greater AA attendance was predicted to be associated with less drinking, and this AA-drinking correlation was expected to be lower in mild or moderately dependent clients (i.e., AA attendance really helps severely dependent clients while an absence of AA predicts failure in these clients).

Results

The prognostic and matching effects involving alcohol dependence were previously reported in Project MATCH Research Group (1997*b*). These findings are summarized below.

Prognostic Effects of Severity of Dependence

The prognostic effects of pretreatment dependence on posttreatment alcohol consumption were examined first. Prognostic analyses were conducted using the same latent growth approach that was utilized in the previously reported analysis of matching effects (Longabaugh and Wirtz, this volume, p. 4; Project MATCH Research Group 1997*a*). The prognostic model included a backward elimination adjustment for the other significant a priori matching attributes and their matching interaction effects. As previously reported, dependence was a significant predictor of PDA in the outpatient arm ($p<.01$), with more severe dependence associated with a *lower* frequency of drinking. Dependence did not predict DDD in the outpatient arm, nor did it predict PDA or DDD in the aftercare arm.

Dependence by Treatment Interaction Effects

Interaction effects were modeled as a "latent growth process" as described in the chapter by Longabaugh and Wirtz (this volume, p. 4) and the Project MATCH Research Group (1997*a*). Table 1 shows F and nondirectional p values for all possible dependence by treatment interaction effects. Our a priori matching hypotheses predicted better outcomes for high-dependence clients in TSF and better outcomes for low-dependence clients in CBT or MET. The predicted interaction effects contrasting CBT versus TSF treatments reached a Bonferroni-corrected level of significance for PDA (directional $p<.01$) and for DDD (directional $p<.01$) outcomes in the posttreatment period in the aftercare arm. Figure 3 shows that these were disordinal interactions. Aftercare clients with severe dependence had better drinking outcomes (higher PDA and lower DDD) when assigned to TSF, while those with low levels of dependence had better outcomes (higher PDA and lower DDD) when assigned to CBT.

To evaluate the clinical relevance of these matching effects, we estimated the PDA and DDD outcomes for clients with pretreatment dependence scores in the highest and lowest decile for the aftercare sample. Matched clients drank on average approximately 7 to 10 percent fewer days or about 2.5 fewer days per month. It is more difficult to interpret differences in DDD because clients who were abstinent for a given posttreatment month were assigned a DDD score of zero for those months.

As shown in table 1, CBT versus TSF treatment by dependence interaction effects were

Table 1. *F* statistics and nondirectional *p* values for all dependence by treatment condition interaction effects

Treatment contrast		Within treatment				Posttreatment			
		MV × Tx		MV × Tx × T		MV × Tx		MV × Tx × T	
		PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD
Outpatient arm									
CBT vs. MET	*F*	0.02	0.40	1.99	1.21	0.41	0.72	1.19	0.00
	p	.89	.53	.16	.27	.52	.40	.28	.96
CBT vs. TSF	*F*	0.40	0.03	0.12	0.25	0.18	0.15	0.56	1.23
	p	.53	.87	.72	.62	.67	.70	.45	.27
MET vs. TSF	*F*	0.59	0.67	1.23	0.42	1.14	0.25	0.15	1.28
	p	.44	.41	.27	.52	.28	.62	.70	.26
MV × Tx	*F*	0.35	0.36	1.08	0.60	0.58	0.36	0.62	0.86
	p	.71	.70	.34	.55	.56	.70	.54	.42
Aftercare arm									
CBT vs. MET	*F*	1.44	1.04	2.53	4.20	2.86	2.13	0.01	0.31
	p	.23	.31	.11	.04	.09	.15	.91	.57
CBT vs. TSF	*F*	1.30	0.34	0.88	2.46	6.30	5.34	1.37	0.12
	p	.26	.56	.35	.12	**.01**	**.02**	.24	.73
MET vs. TSF	*F*	0.00	0.17	0.35	0.18	0.62	0.69	1.00	0.74
	p	.97	.68	.55	.68	.43	.41	.32	.39
MV × Tx	*F*	0.95	0.53	1.30	2.37	3.37	2.79	0.78	0.38
	p	.39	.59	.27	.09	.03	.06	.46	.69

NOTE: MV=matching variable, Alcohol Dependence; Tx=treatment; T=time; PDA=percentage of days abstinent; DDD=drinks per drinking day

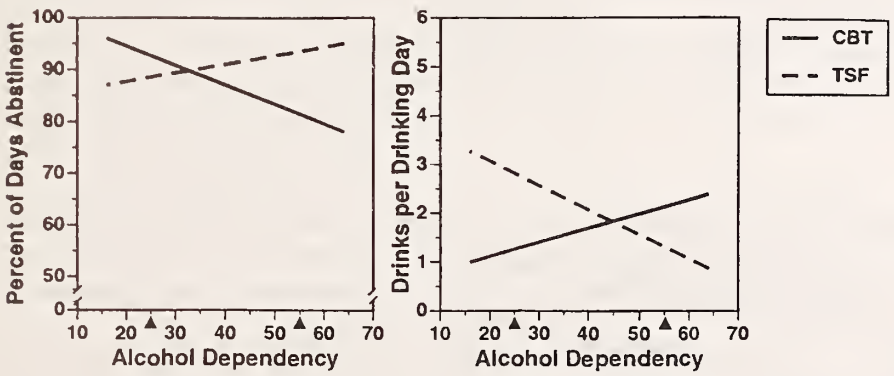

Figure 3. Posttreatment plot of percentage of days abstinent and drinks per drinking day in the aftercare arm showing the interaction between CBT and TSF treatments and baseline alcohol dependence. The vertical axes represent predicted outcome scores, and the horizontal axes represent baseline alcohol dependence, with higher scores indicating higher dependence. The triangles on the horizontal axes indicate the 10th and 90th percentiles for alcohol dependence in the aftercare arm. (Reprinted with permission from *Journal of Studies on Alcohol*, Vol. 58, pp. 7–29, 1997. Copyright by Alcohol Research Documentation, Inc., Rutgers Center of Alcohol Studies, Piscataway, NJ 08854.)

significant predictors of outcome in the aftercare arm in the posttreatment period. However, this matching contrast was not significant during the active treatment period, nor was it significant in the outpatient arm in the within-treatment or posttreatment periods. In addition, none of the expected interaction effects contrasting TSF and MET treatments was significant.

In order to gain another perspective on the magnitude of the alcohol dependence-matching effects, we examined the impact of applying a dependence matching strategy on a composite

outcome variable. The entire sample of aftercare subjects was divided into matched or mismatched groups. High-dependence subjects were considered matched when they were randomly assigned to TSF and mismatched when randomly assigned to CBT, while low-dependence subjects were considered matched when assigned to CBT and mismatched when assigned to TSF. Subjects in the aftercare sample were divided into low- and high-dependence groups with the cut point based on the EDSS score at the intersection point in figure 3. Scores less than or equal to 35 were classified low dependence and scores greater than 35 were classified high dependence.

Outcome was examined using a composite outcome variable based on drinking measures from the Form 90 (Miller 1996) and alcohol-related negative consequences from the DrInC questionnaire ((Miller et al. 1995; see Zweben and Cisler 1996 for a description of the composite outcome variable). Outcome was classified as a "success" when a subject reported no heavy drinking or alcohol-related negative consequences in the preceding 3 months. Outcome was classified as a "failure" when a subject reported any heavy drinking and/or consequences in the 3-month window. Figure 4 reveals that the maximum matching effect in the aftercare arm on the composite outcome measure occurred during the 4 to 9 months after termination of treatment. Matched clients had an approximately 10-percent higher success rate than mismatched clients and an approximately 5-percent higher success rate than unmatched (randomly assigned) clients.

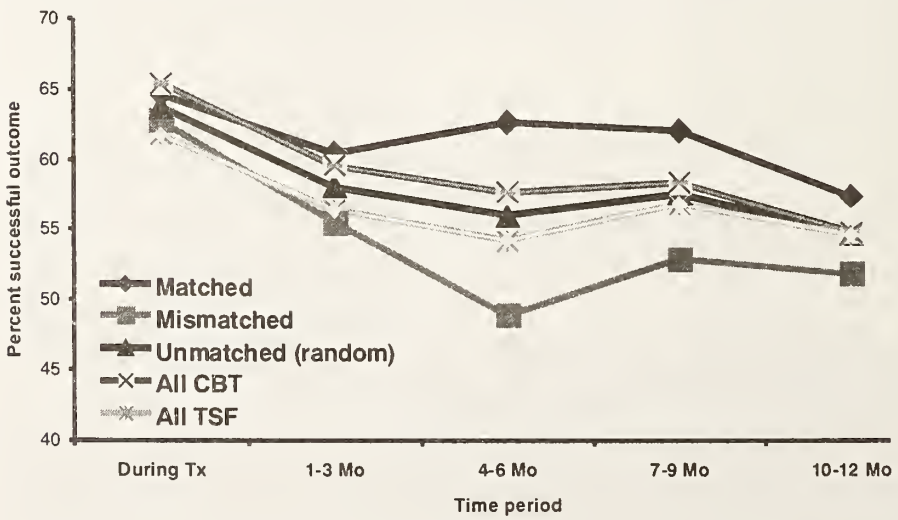

Figure 4. Alcohol dependence matching effects on composite outcome across time. Matching to CBT versus TSF, aftercare arm. Matching strategy: EDSS <35 assigned to CBT; EDSS > 35 assigned to TSF.

Causal Chain Results for Emphasis on Abstinence

The first causal chain analysis tested for the possible mediating role of differential emphasis on abstinence versus moderation and loss of control versus lapse coping. The assessment of treatment process in Project MATCH used methodology adapted from the National Institute of Mental Health Collaborative Study on Treatment of Depression (Elkins et al. 1985). Every Project MATCH session was videotaped, and Likert-type items for rating these tapes were generated from treatment manuals. After the MATCH Tape Rating Scale (MTRS) was developed, all session tapes from the second week of treatment and a randomly selected subsample of 150 week-6 session tapes were rated (see Carroll et al. 1998 for a detailed description of the MTRS). The following items from the MTRS were analyzed as potential mediating variables.

- Item 40. To what extent did the therapist discuss or address the patient's commitment to abstinence? (*Commitment to Abstinence*)
- Item 46. To what extent did the therapist explicitly discuss the rationale for/advantages of a treatment goal of abstinence OR the disadvantages of a treatment goal of reduction rather than cessation of alcohol use? (*Abstinence as a Goal*)
- Item 47. To what extent did the therapist convey to the patient that a slip does not necessarily mean that the patient will experience a full-blown relapse? (*Slip Is Not Relapse*)

Is there a greater emphasis on abstinence as the goal of treatment in TSF than in CBT or MET? The mean ratings on

items measuring commitment to abstinence, abstinence as a treatment goal, and the belief that a slip is not a relapse were examined by treatment condition for the outpatient and aftercare samples. Multivariate tests indicated main effects of treatment condition on these MTRS items in both the outpatient arm (Wilk's Lambda=0.89; $F(6, 1462)=15.02$; $p<.001$) and the aftercare arm (Wilk's Lambda=0.84; $F(6, 1214)=18.68$; $p<.001$).

In the outpatient arm, univariate tests suggested that the items measuring Commitment to Abstinence ($F(2, 733)=14.08$; $p<.001$) and Abstinence as a Goal ($F(2, 733)=16.76$; $p<.001$) were responsible for the effect. There were no significant differences among treatments on the Slip Is Not Relapse item. Scheffé multiple comparisons, contrary to predictions, indicated the MET sessions were rated higher than CBT or TSF sessions on Commitment to Abstinence. On the other hand, as predicted, TSF was rated higher than CBT or MET on the Abstinence as a Goal item (table 2).

In the aftercare arm, univariate tests again found differences on Commitment to Abstinence ($F(2, 609)=29.38$; $p<.001$), and on Abstinence as a Goal ($F(2, 609)=7.99$; $p<.001$) but not on Slip Is Not Relapse. Scheffé multiple comparisons, contrary to predictions, indicated that MET was higher than TSF, but consistent with predictions, TSF was higher than CBT on Commitment to Abstinence. Also consistent with predictions, TSF was higher than CBT or MET on Abstinence as a Goal.

The answer to the causal chain question posed above is somewhat mixed. In both the outpatient and aftercare arms, there was a greater emphasis on abstinence as a goal of treatment in the TSF sessions. High scores for the MET condition on Commitment to Abstinence may be the result of MET's explicit focus on encouraging commitment to change. The absence of high scores on Abstinence as a Goal in the MET condition suggests that the MET focus on commitment to change was not always a focus on commitment to abstinence. With this pattern of tape-rating results in mind, we decided to conduct further causal chain analyses on the Abstinence as a Goal item, believing that it had the best potential to reflect the process underlying dependence matching effects.

Do differences in emphasis on abstinence have a differential impact on clients with high and low dependence? We expected that a greater degree of emphasis on abstinence would result in less drinking among clients with high dependence, while a lack of emphasis on abstinence would result in less drinking among clients with low dependence. To test this, we examined the dependence by emphasis on abstinence interaction effect in a series of repeated-measures analyses of variance (ANOVA)models containing the following terms: baseline drinking, site, main effect of dependence, and main effect of emphasis on abstinence. Dependent variables were monthly PDA and DDD in separate analyses.

Table 2. Means and (*SD*s) for Emphasis on Abstinence items from the MATCH Tape Rating Scale

	Outpatient			Aftercare		
	CBT n=233	MET n=249	TSF n=264	CBT n=210	MET n=209	TSF n=193
Commitment to Abstinence	1.76 (.93)	2.22 (1.07)	1.88 (1.02)	1.41 (.79)	2.15 (1.09)	1.65 (.86)
Abstinence as a Goal	1.37 (.71)	1.54 (.86)	1.88 (1.10)	1.18 (.58)	1.27 (.59)	1.56 (.89)
Slip Is Not Relapse	1.28 (.64)	1.17 (.51)	1.25 (.57)	1.23 (.75)	1.22 (.69)	1.25 (.59)

NOTE: MATCH Tape Rating Scale items range from 1 to 5.

In the outpatient arm, the dependence by emphasis on abstinence interaction effect was not significant for either PDA or DDD. On the other hand, this interaction effect was significant in the aftercare arm for both PDA ($F(1, 351)=5.60$; $p<.05$) and for DDD ($F(1, 351)=4.78$; $p<.05$). Figure 5 shows this interaction effect, revealing that low-dependent aftercare clients had better PDA outcomes when assigned to therapists who did not give an abstinence message. High-dependent aftercare clients had equivalent outcomes regardless of the degree of emphasis on abstinence.

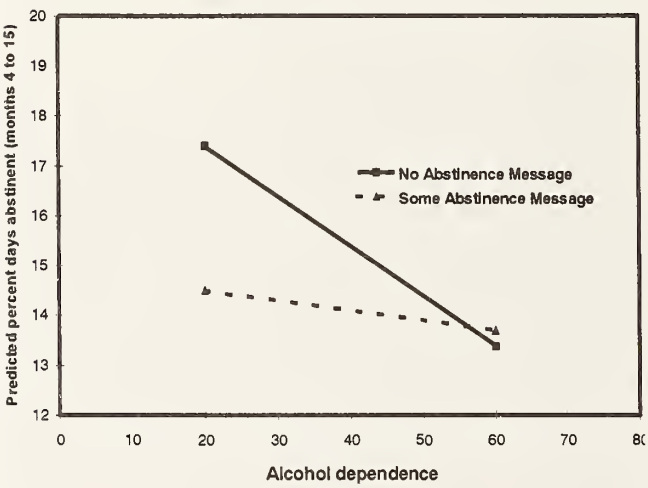

Figure 5. Interaction of therapy emphasis on abstinence with alcohol dependence in the aftercare arm, CBT and TSF clients only.

The ultimate test of whether or not emphasis on abstinence mediated the dependence-matching effect is to examine a repeated-measures ANOVA model containing both a treatment by dependence term and an emphasis on abstinence by dependence term along with their associated main effects. When this was done, the treatment by dependence term was made nonsignificant for PDA outcome ($F(1, 344)= 1.85$; $p>.1$) and for DDD outcome ($F(1, 344)= 3.40$; $p>.05$). This supports the conclusion that, particularly for PDA outcome, the alcohol dependence matching effect in the aftercare arm was mediated by differences in the degree of therapist emphasis on abstinence.

AA Attendance Causal Chain Results

Do severely dependent clients attend more AA meetings than less dependent clients? Do TSF clients attend more AA meetings than CBT or MET clients? Frequency of AA meeting attendance was assessed by research interviews conducted at posttreatment and at 3, 6, 9, and 12 months following treatment. Repeated-measures analysis of covariance (ANCOVA) using type-1 sum of squares (i.e., a hierarchical procedure) was used to determine the effects of pretreatment dependence and treatment assignment on the five repeated measures of AA meeting attendance, adjusting for site differences. Factors were entered in the following order: site, treatment assignment, baseline dependence, and the interaction of treatment with dependence.

In the outpatient arm, AA meeting attendance was associated with higher dependence ($F(1, 831)=24.39$; $p<.001$), with treatment assignment ($F(2, 831)=20.48$), and with a significant dependence by treatment interaction ($F(2, 831)=5.31$; $p<.01$). Although dependence was analyzed as a continuous variable, it was trichotomized to illustrate these effects. As shown in figure 6, the high-dependence outpatient clients assigned to TSF treatment attended approximately twice as many AA meetings as did clients assigned to CBT or MET.

Among aftercare clients, AA meeting attendance was also associated with higher dependence ($F(1, 673)=16.31$; $p<.001$) and with treatment assignment ($F(2, 673)=6.36$; $p<.001$). However, the treatment by dependence interaction effect was nonsignificant. Thus, it is concluded that in both the outpatient and aftercare arms, TSF resulted in more AA meeting attendance than CBT or MET, and more severely dependent clients were more likely to attend AA meetings. The relationship between dependence and AA attendance is particularly strong in the outpatient TSF treatment condition.

Is AA attendance predictive of less alcohol consumption? Does AA attendance have a differential impact on clients with high and low dependence? Repeated-measures ANCOVA using type-1 sum of squares was used to determine the predictive effects of within-treatment AA

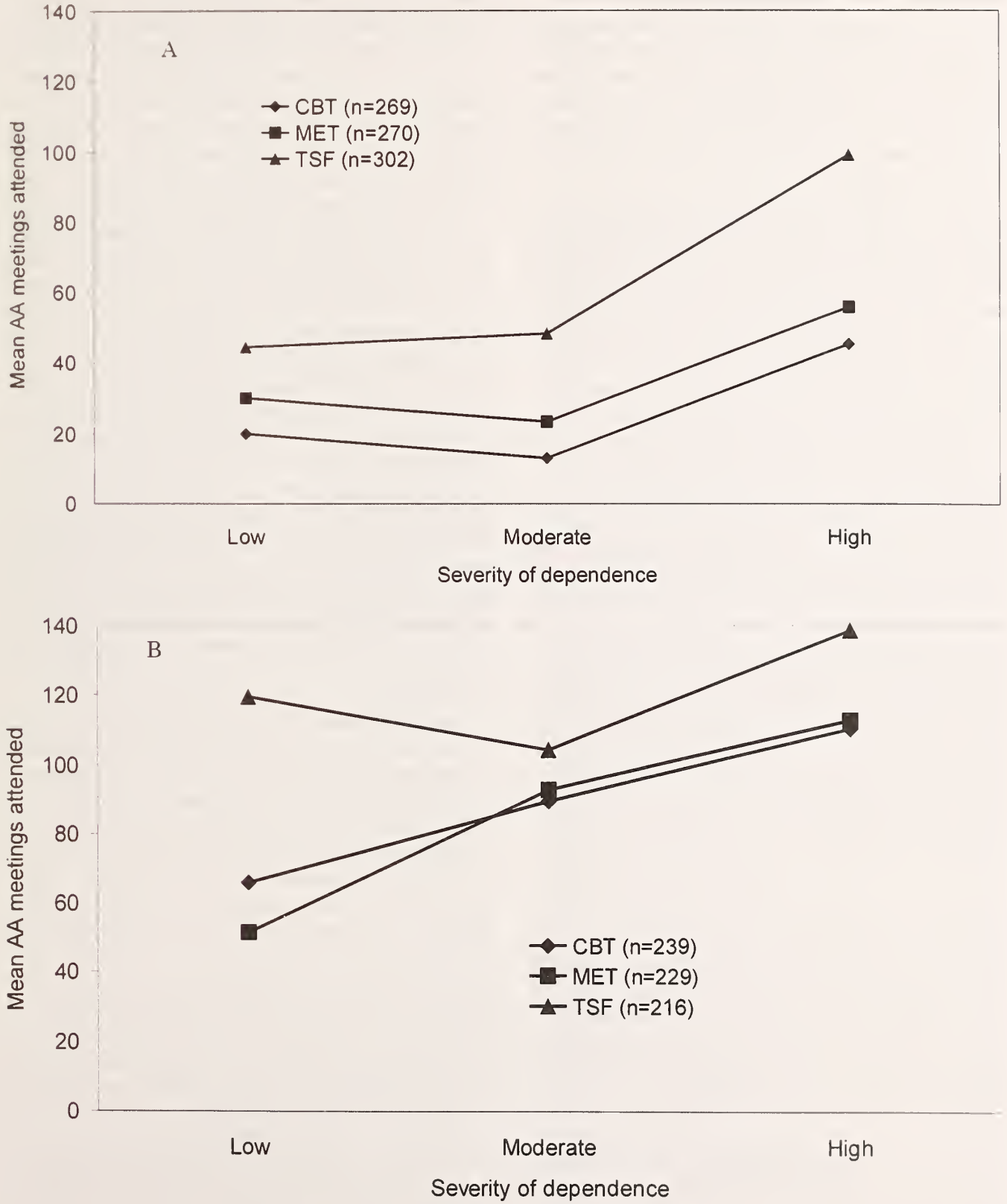

Figure 6. AA attendance by dependence score for each treatment condition. (*A*) Outpatient arm (N=841). (*B*) Aftercare arm (N=684)

attendance and treatment assignment on 12 monthly measures of drinking, adjusting for site differences. In these analyses, baseline drinking was the covariate. Factors were then entered in the following order: AA attendance during treatment, baseline dependence score, and the interaction of AA attendance with baseline dependence.

In the outpatient arm, more frequent AA attendance within treatment was positively associated with PDA in the year after treatment ($F(1, 843)=47.13$; $p<.001$), and the AA attendance by dependence interaction was not significant. DDD outcome results were similar, with a significant prognostic effect found for AA attendance ($F(1, 843)=41.07$; $p<.001$) and a nonsignificant AA attendance by dependence interaction.

Aftercare arm results mirrored those in the outpatient arm. AA attendance within treatment was predictive of PDA outcome ($F(1, 670)=40.51$; $p<.001$), with a nonsignificant AA attendance by dependence interaction. Similarly, AA attendance predicted DDD in the aftercare arm, with a nonsignificant AA attendance by dependence interaction.

In summary, in both the outpatient and aftercare arms, TSF clients attended more AA meetings than CBT or MET clients, severity of alcohol dependence was a strong predictor of AA attendance, and AA attendance was a strong predictor of drinking outcome. However, no evidence was found in either arm for an AA attendance by dependence interaction effect. This interaction effect also was not significant when the analyses were repeated using only clients assigned to the CBT and TSF conditions. Thus, we do not have evidence to support the hypothesis that differences in AA attendance mediated the dependence treatment-matching effect involving CBT and TSF treatments. Although elements of the AA attendance causal chain were supported, the overall chain does not explain the dependence-matching effects.

Discussion

The degree of alcohol dependence has long been considered an important variable in planning treatment (Lindstrom 1992). In the present study, it was hypothesized that TSF, a treatment that was thought to put greater emphasis on the need for total abstinence (because of the alcoholic's assumed powerlessness over alcohol), would be more effective with highly dependent clients than either CBT, which teaches relapse prevention skills, or MET, which focuses on motivating clients to develop their own strategy to achieve abstinence. In addition, it was hypothesized that CBT would be more effective with clients at low levels of dependence because they could make greater use of coping skills. Finally, low-dependence clients were expected to respond well to MET because they might prefer its greater flexibility regarding abstinence versus nonabstinence treatment goals.

In contrast, low-dependence clients treated in TSF were expected to do poorly because the disease concept promoted by AA, with its emphasis on loss of control, would be inconsistent with their experience. To the extent that a major feature of severe dependence is impaired control over drinking, TSF is likely to be more effective with severely dependent alcoholics because of its assumption that loss of control occurs immediately with alcohol ingestion and its emphasis on the need to obtain support from the AA Fellowship.

The results from the aftercare treatment arm of the trial were consistent with the outcome predictions involving the TSF versus CBT contrast. Clients low in dependence had better outcomes when treated in CBT than when treated in TSF, while those high in dependence had better outcomes in TSF than in CBT. When clients were matched to CBT or TSF treatments using a cut point of 35 on the Ethanol Dependence Syndrome Scale, the success rate for matched clients was approximately 10 percent higher than for mismatched clients and approximately 5 percent higher than for randomly assigned clients. These effects are not large, so clinicians should expect only modest gains from using this matching strategy.

Although there was support for the alcohol dependence-matching hypothesis in the aftercare arm, there was no evidence for matching in the outpatient arm. There also was no evidence of matching effects involving the TSF versus MET contrast. TSF versus CBT matching

effects observed in the aftercare arm were not evident during the treatment phase. These effects only emerged in the year following termination of treatment.

There are several possible explanations for the finding of some significant dependence matching only in the aftercare arm. First, the distribution of dependence scores in the aftercare sample contained many more clients with high dependence than did the outpatient sample. Sixty-four percent of the aftercare sample met the definition of high dependence, compared with only 37 percent of the outpatient sample. It is therefore possible that there was not a sufficient number of high-dependence clients in the outpatient sample to find a dependence matching effect. Recent changes in treatment practices might result in a greater number of severely dependent clients being admitted directly to low-intensity outpatient treatment than was the case when Project MATCH was conducted. If the difference in matching effects across Project MATCH arms is due to the baseline dependence distribution, then outpatient settings with greater numbers of highly dependent clients might also find dependence-matching effects.

A second possible explanation for the lack of matching effects in the outpatient arm is that aftercare clients probably received more encouragement to totally abstain from drinking and to attend AA meetings in the context of the intensive treatment delivered prior to randomization to Project MATCH therapies. This may have provided highly dependent aftercare clients assigned to TSF with a greater overall dose of matched treatment, while aftercare clients with low dependence assigned to TSF received an overall greater dose of mismatched treatment. On the other hand, outpatient clients in TSF may not have received enough of a 12-step dose to produce dependence-matching effects. This explanation would imply that a greater intensity or duration of TSF may be needed to produce matching effects among clients directly admitted to outpatient treatment.

A third potential reason for the differences among study arms is that aftercare clients were more likely to have "hit bottom," suffering severe negative consequences of drinking. This could have made it more likely that they would recognize their need for the support of AA.

The expected TSF versus MET matching effect did not emerge. This hypothesized matching contrast was in part based on the idea that severely dependent clients needed more than the client-generated strategies employed in MET. However, severely dependent clients assigned to MET in the aftercare arm actually received a substantial amount of other therapy prior to the start of their MET aftercare therapy. This prior treatment may have diluted the difference between aftercare MET and TSF in intensity of treatment, washing out any potential MET versus TSF matching effect.

Causal chain analyses shed some light on the processes underlying the aftercare CBT versus TSF matching effects. Ratings of videotapes obtained from therapy sessions confirmed the expectation that TSF treatment had a greater emphasis on abstinence as a goal of treatment than CBT treatment. Research on controlled drinking (Sobell and Sobell 1995) suggests that the recovery of severely dependent individuals predominantly involves abstinence, while the recovery of those who are not severely dependent predominantly involves moderate drinking. The association between dependence severity and outcome type appears to be independent of advice provided in treatment. Thus, dependence-matching effects may have occurred in Project MATCH because clients preferred and participated more actively in treatments that emphasized recovery outcomes that they had an inherent likelihood of achieving.

Another causal chain model that was not fully supported was the idea that the matching effects were mediated by differences in AA attendance. We did find that severely dependent clients were more likely to attend and get involved in AA meetings than were clients without severe dependence. These results are consistent with the findings of a meta-analysis (Emrick et al. 1993) that reported that AA affiliation was modestly associated with variables indicative of dependence (greater loss of control over drinking, higher daily quantity of alcohol consumption, more physical dependence, more severity of dependence, and more obsessive-compulsive involvement with drinking). We

also found that greater AA attendance during treatment was predictive of better posttreatment outcomes. What was missing from this causal chain was evidence that AA attendance had a differential impact on clients with high and low dependence.

Conclusions

- On intake, clients were administered the 16-item Ethanol Dependence Syndrome Scale (EDSS). After an intensive treatment episode, outcomes were improved by matching those with high dependence (scoring greater than 35 on the EDSS) to TSF and by matching those with low dependence (less than or equal to 35 on the EDSS) to CBT. Matched clients had an approximately 10-percent higher success rate than mismatched clients.
- Matching effects were not observed when clients were directly admitted to the low-intensity 12-session outpatient treatments without prior intensive treatment.
- Process analyses supported the hypothesis that the alcohol dependence-matching effect in the aftercare arm was mediated by differences in the degree of therapist emphasis on abstinence. Only partial support was found for another causal chain hypothesis that differences in AA attendance mediated the dependence treatment matching effect.

Acknowledgments

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The Alcohol Involvement Matching Hypothesis and Findings

Robert G. Rychtarik, Ph.D., William R. Miller, Ph.D., and J. Scott Tonigan, Ph.D.

ABSTRACT

Individuals high in alcohol involvement were predicted to have better outcomes in Cognitive-Behavioral Coping Skills Therapy and Twelve Step Facilitation relative to Motivational Enhancement Treatment. It was hypothesized that differences in the intensity of these treatments moderated this alcohol involvement by treatment interaction through indirect effects on within-treatment drinking, within-treatment consequences, and post-treatment self-efficacy. However, results failed to show a significant interaction between alcohol involvement and treatment. Closer examination revealed that, contrary to predictions, alcohol involvement was more positively associated with outcome among outpatient clients as the followup period progressed. This positive association with outcome appeared mediated by the greater motivation of high alcohol-involved individuals and their increased likelihood of attending Alcoholics Anonymous (AA). Among aftercare clients, alcohol involvement was associated with poorer overall outcomes. However, alcohol involvement's effects were not moderated by treatment intensity. The results suggest that alcohol involvement's influence on outcome is complex and varies with the treatment population, client motivation, and posttreatment AA attendance.

Alcohol involvement was conceptualized as a broad, multifaceted construct representing the severity of an individual's alcohol problem. The construct was meant to include but extend beyond the narrower concept of alcohol dependence (i.e., psychoperceptual and psychophysical withdrawal symptoms). As such, alcohol involvement also reflects the extent to which an individual's lifestyle is directed and influenced by drinking. These additional facets include the extent to which an individual drinks in a sustained fashion, is obsessed with drinking, and has experienced social consequences as a result of drinking (e.g., unemployment, solitary lifestyle, detention by authorities).

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The Rationale for the Matching Hypothesis

A basic assumption providing the foundation for the current hypothesis is that as alcohol involvement increases there are fewer abstinent days and more drinks per drinking day after treatment. Although specific measures of alcohol involvement have varied across studies, there exists some empirical support for this assumption (e.g., Horn et al. 1990; Rounsaville et al. 1987). The presumed relationship between alcohol involvement and drinking outcomes also suggests that individuals at different alcohol involvement levels may respond differentially to different treatment types. In particular, it is a common belief that individuals with more severe drinking problems benefit from more intense treatments.

Unfortunately, there has been no direct test of the assumption that high alcohol-involved

individuals benefit from treatments of higher intensity. There is, however, some evidence in the treatment outcome literature that treatment intensity may interact with problem severity to influence outcome. Most relevant to the current discussion is the study of Orford and colleagues (1976). They differentiated 100 married alcoholics into gamma and nongamma types and found at a 2-year followup that among gammas, all successful outcomes occurred in the more intensive outpatient condition, whereas among nongammas, successes were predominant in the minimal advice condition. So, a cross-over effect was found, with outcome status influenced by the interaction between treatment type and problem severity. It should be noted that recent findings failed to replicate these results in the same sample at the 1-year followup (Edwards and Taylor 1994). Still, the Orford group's results have had wide impact and were extended to develop the present hypothesis for the MATCH trial.

Advice in the study by Orford and associates consisted of a half day's assessment that included a summary evaluation informing the client of the alcohol problem and of the need to do something about it. This condition bears a generic similarity to Motivational Enhancement Therapy (MET; Miller et al. 1992), which in total amounts to several hours of assessment followed by four therapy sessions over 12 weeks. The procedure of providing important feedback to the client as a motivator for change of lifestyle also is shared by Brief Advice and MET.

In like fashion, the MATCH Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992) and Twelve Step Facilitation (TSF; Nowinski et al. 1992) conditions share with the Orford team's intensive outpatient condition a greater amount of therapeutic contact at a more intensive level. The presumed active ingredients of differential intensity and amount of treatment in the Orford group's study would also differentiate CBT and TSF from MET in the MATCH study.

While there is no direct correspondence between gamma and nongamma alcoholism in the Orford study and alcohol involvement as measured here, the constructs do share common attributes. The gamma alcoholic is a more severe type characterized by both major symptoms *and* physical dependence. Nongamma alcoholics are less severe and do not have signs of both symptoms and physical dependence. In the MATCH study, alcohol involvement, characterized as a continuous variable, included level of alcohol dependence and symptoms/consequences as part of its definition. Thus, the extrapolation of an interaction between alcohol involvement and treatment intensity, much as Orford and colleagues found between alcoholic type and intensity, appears justified.

The Alcohol Involvement Prognostic Model

Figure 1*a* provides a general model for conceptualizing the effect of alcohol involvement on posttreatment outcome. In this model, alcohol involvement is expected to have a direct negative effect on outcome. In addition, a series of indirect effects of alcohol involvement on outcome are predicted. These indirect effects occur through alcohol involvement's presumed negative effect on pretreatment self-efficacy, within-treatment outcomes, and posttreatment self-efficacy. In addition, alcohol involvement is expected to have a positive association with within-treatment drinking consequences. Pretreatment self-efficacy, posttreatment self-efficacy, and within-treatment drinking outcomes are predicted to be positively associated with followup outcomes. Drinking consequences, on the other hand, are expected to be negatively associated with outcome.

The model assumes that individuals high in alcohol involvement, by definition, have a history of failed treatment attempts which will increase the likelihood of poorer overall outcome in the future. Similarly, this history of treatment failure is presumed to result in lower self-efficacy both initially and at the end of treatment. Self-efficacy at the end of treatment also is expected to be influenced positively by outcome experiences during treatment and negatively by within-treatment drinking consequences. Based on the prior literature (Rychtarik et al. 1992), self-efficacy is assumed to be positively associated with both within-treatment and followup outcome measures. It also is anticipated that within-treatment outcomes will be positively associated with outcomes at followup.

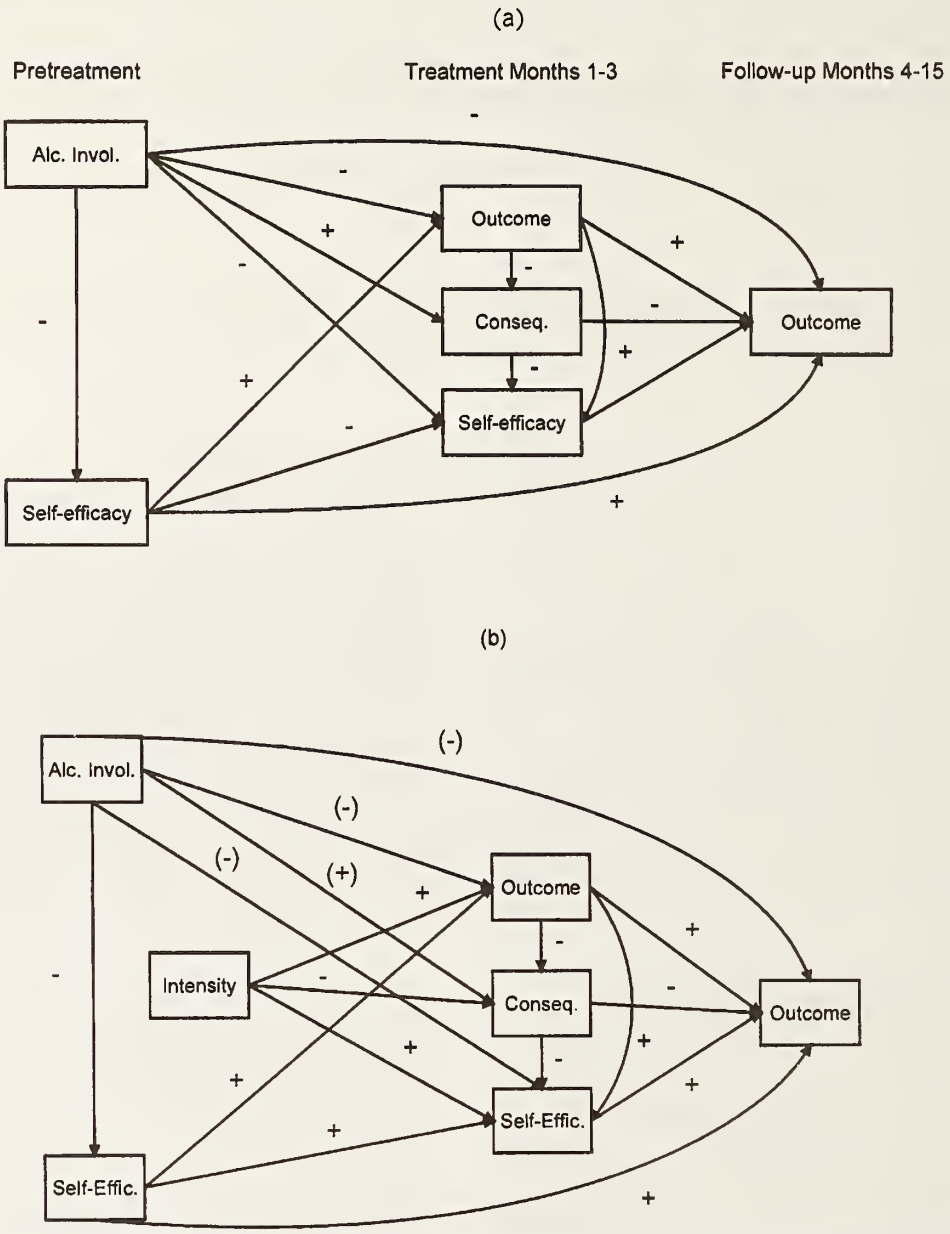

Figure 1. Proposed causal model of (*a*) alcohol involvement and (*b*) treatment intensity on outcome. Parentheses in (*b*) represent alcohol involvement effects moderated by intensity.

The Moderating Effects of Treatment Intensity

Figure 1*b* presents the alcohol involvement model, including the moderating effects of treatment intensity. Treatment intensity, as measured by the number of treatment sessions attended over the period, was hypothesized to buffer or moderate the direct or indirect effects of alcohol involvement on within-treatment variables. It was hypothesized that more intense treatments, by definition, provide the opportunity for more frequent monitoring of the individual's efforts to remain abstinent. So, frequent sessions are more likely to detect and address a return to drinking in the 12-week treatment period than would be the case if fewer sessions were attended. Since high alcohol-involved clients, by definition, may be more susceptible to more frequent and heavier drinking

during treatment, the opportunity to monitor drinking status more frequently offers the possibility of increasing the number of abstinent days postintake, subsequently reducing the number of drinking-related consequences during treatment, and in turn, increasing an individual's confidence in resisting further drinking (i.e., self-efficacy). So, while alcohol involvement would tend to lower the percentage of abstinent days within treatment, more and frequent sessions would buffer this effect and diminish the negative within-treatment relationship between alcohol involvement and percentage of days abstinent.

Several features of the model presented in figure 1*b* should be noted. First, we used the treatment intensity measure (i.e., number of treatment sessions attended) rather than a treatment condition variable to distinguish the low intensity Project MATCH MET from the CBT and TSF. We chose this approach for two reasons. First, although the three treatment conditions varied in philosophy and approach, the current hypothesis assumes that intensity alone moderates the alcohol involvement effect. Clear differences in the average number of sessions attended by MET versus CBT and TSF clients were observed. So, the intensity measure provides a way to discriminate between MET and the CBT and TSF treatments.

Second, inclusion of a treatment condition variable in the model would add error to the intensity measure since the actual number of sessions attended in CBT and TSF varied among clients. Clients attending only a few sessions of CBT and TSF would be expected to benefit no more than individuals in MET. Finally, the model assumes that treatment intensity positively influences outcome through its indirect effects on within-treatment drinking, within-treatment drinking consequences, and post-treatment self-efficacy. No direct effect of treatment intensity on outcome is hypothesized.

Statement of the Matching Hypothesis

On the basis of the above models, it was hypothesized that the greater the client's alcohol involvement prior to treatment, the higher the percentage of days abstinent (PDA) and the lower the drinks per drinking day (DDD) among clients treated in the TSF and CBT conditions (i.e., the intense conditions) relative to those treated in MET. In statistical terms, it was predicted that the slope of the relationship between alcohol involvement and outcome variables would differ significantly between the intense (CBT/TSF) and less intense (MET) treatment conditions.

Operationalization of the Matching Variable

The raw score of the broad alcohol involvement scale (ALCINVOL) of the Alcohol Use Inventory (AUI; Horn et al. 1990) was used as the matching variable. The AUI and its subscales are widely recognized as among the best developed measures in this area. The AUI also assumes a contemporary, multifaceted view of the alcohol involvement concept which is consistent with that of the current hypothesis. The ALCINVOL scale is a third-order scale that measures a cluster of symptoms representative of the construct of alcohol involvement (i.e., obsession with drinking, sustained drinking, perceptual withdrawal, somatic withdrawal, social role maladaptation, loss of control of behavior). The internal consistency of this scale is good (0.93). In addition, the scale has shown reasonable construct and criterion validity (Horn et al. 1990; Skinner and Allen 1983).

Results

Outpatient Arm

Prognostic Effect of Alcohol Involvement

Contrary to predictions, no significant alcohol involvement effect or alcohol involvement by time interaction was observed for either PDA or DDD during the treatment period. There was, however, a significant ($p<.05$) main effect for alcohol involvement on abstinent days during followup, $F(1, 9809)=6.37$, $p=.01$, and a significant

alcohol involvement by linear time interaction, $F(1, 9809)=4.92$, $p=.03$. On the DDD measure, there was no significant main effect of alcohol involvement, but a significant alcohol involvement by linear time interaction again emerged, $F(1, 9809)=4.73$, $p=.03$.

The nature of these alcohol involvement by time interactions was explored by examining the partial correlations between alcohol involvement and each of the primary dependent measures for each followup month, controlling for pretreatment abstinent days, clinical research unit, and treatment assignment. Figure 2 presents the partial correlations between alcohol involvement and PDA and DDD across followup months. As shown, the relationship between alcohol involvement and PDA *increased* linearly from nonsignificant levels in the first few months to a small significant association by month 15. For DDD, the relationship was reversed, with the association between alcohol involvement and DDD decreasing from a nonsignificant level in month 4 to a significant negative association at month 15. In sum, greater severity of alcohol involvement was associated with *better* outcomes (i.e., more abstinent days and fewer DDD) as the followup progressed. This unanticipated positive association between alcohol involvement and outcome was maintained at a 39-month followup. At 39 months, alcohol involvement was correlated positively with PDA ($r=0.15$, $p<.001$) and negatively with DDD ($r=-0.08$, $p<.05$).

Interaction of Alcohol Involvement With Treatment

Table 1 presents the results of the tests of the overall alcohol involvement by treatment interaction terms for PDA and DDD for both treatment and followup periods. Also included are tests of the effects of the interaction over linear and quadratic time as well as tests of the individual predicted contrasts. No overall significant treatment by alcohol involvement interaction was found. Individual contrasts also showed no significant difference in slope between CBT or TSF and MET conditions for either PDA or DDD either during treatment or in the 4–15 month followup period. These contrasts also did not vary with time in either period. At the 39-month followup, there was no significant alcohol involvement by treatment interaction.

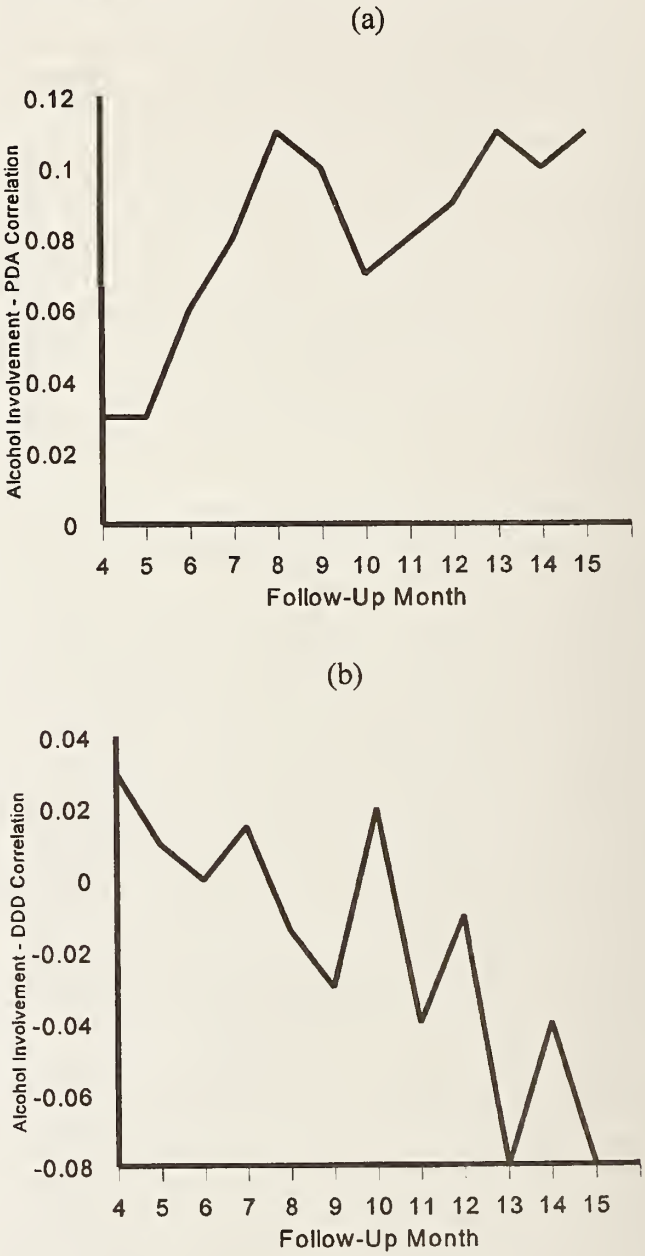

Figure 2. Partial correlations between pretreatment alcohol involvement and (*a*) percentage of days abstinent (PDA) and (*b*) drinks per drinking day (DDD) across followup months 4–15. Pretreatment PDA/DDD, clinical research unit, and treatment type are controlled for.

Table 1. Alcohol involvement, outpatient

Treatment contrast		Within treatment						Posttreatment					
		Mv × Tx		Mv × Tx × T		MV × Tx × T^2		Mv × Tx		Mv × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD
CBT vs.	*F*	1.03	1.19	0.30	0.49	1.61	-0.76	-1.63	1.20	0.89	-0.70	1.70	0.26
MET	*p*	.30	.23	.77	.62	.11	.45	.10	.23	.38	.48	.09	.79
CBT vs.	*F*	-0.53	0.85	-1.10	0.80	-0.10	-0.34	-0.96	1.17	1.96	-1.78	0.75	-0.46
TSF	*p*	.60	.40	.27	.43	.92	.74	.33	.24	.05	.08	.46	.64
MET vs.	*F*	0.56	-0.41	-1.40	0.27	-1.79	0.46	0.76	-0.10	1.00	-1.02	-1.05	-0.73
TSF	*p*	.58	.68	.16	.78	.07	.64	.44	.92	.32	.31	.30	.46
MV × Tx	*F*	0.53	0.75	1.12	0.32	1.89	0.29	1.34	0.92	1.93	0.37	1.45	0.58
	p	.59	.47	.33	.73	.15	.75	.26	.40	.14	.94	.23	.79

NOTE: MV=matching variable, Alcohol Involvement; T=linear time ; T^2=quadratic time; Tx =treatment ; PDA=percentage of days abstinent; DDD=drinks per drinking day

Examination of the A Priori Alcohol Involvement Model

The reversal of the predicted relationship between alcohol involvement and outcome indicated a significant failure of the proposed causal models, which had predicted a negative association. In itself, a positive association between alcohol involvement and PDA would be sufficient to obviate the predicted matching effect. Path analyses using EQS (Bentler 1992) subsequently were conducted to examine both direct and indirect effects of alcohol involvement on outcome in the alcohol involvement and treatment intensity models presented in figure 1. Since these models deviated from multivariate normality, the significance of individual parameter coefficients was determined using robust estimation methods (Bentler 1992). For similar reasons, we used the Satorra-Bentler chi square statistic as an indication of model fit. We refrained from using model fit indexes since model fit already is reflected in the model chi square. Also, model fit indexes can be deceptive given the high specificity of the models (i.e., nearly all potential pathways are included in the model). Standardized values for direct effects are used in the remainder of this chapter.

In the models evaluated, the confidence minus temptation score of the Alcohol Abstinence Self-Efficacy Scale (DiClemente et al. 1994) was used as a measure of self-efficacy both at pretreatment and at the end of treatment. The total consequence score of the Drinker Inventory of Consequences (Miller et al. 1995) was used as the measure of drinking consequences within treatment. Within-treatment PDA and DDD each were computed by averaging across treatment weeks. Followup PDA and DDD similarly were averaged across followup months. Arcsine and square root transformations subsequently were applied, respectively, to average PDA and DDD measures.

Results of tests of the alcohol involvement models for PDA and DDD are presented in figure 3. A decomposition of alcohol involvement effects is presented in table 2. Consistent with the results presented above, but contrary to our hypothesized causal model, alcohol involvement had a small, significant positive direct effect on both within-treatment and posttreatment PDA. No significant overall indirect effect of alcohol involvement on followup PDA was found.

Nevertheless, several indirect pathways were at least partially consistent with our model. For example, alcohol involvement was positively associated with drinking-related consequences during treatment. However, within-treatment drinking consequences were associated with *better* outcomes during followup (i.e., a greater PDA) rather than worse outcomes, as had been predicted.

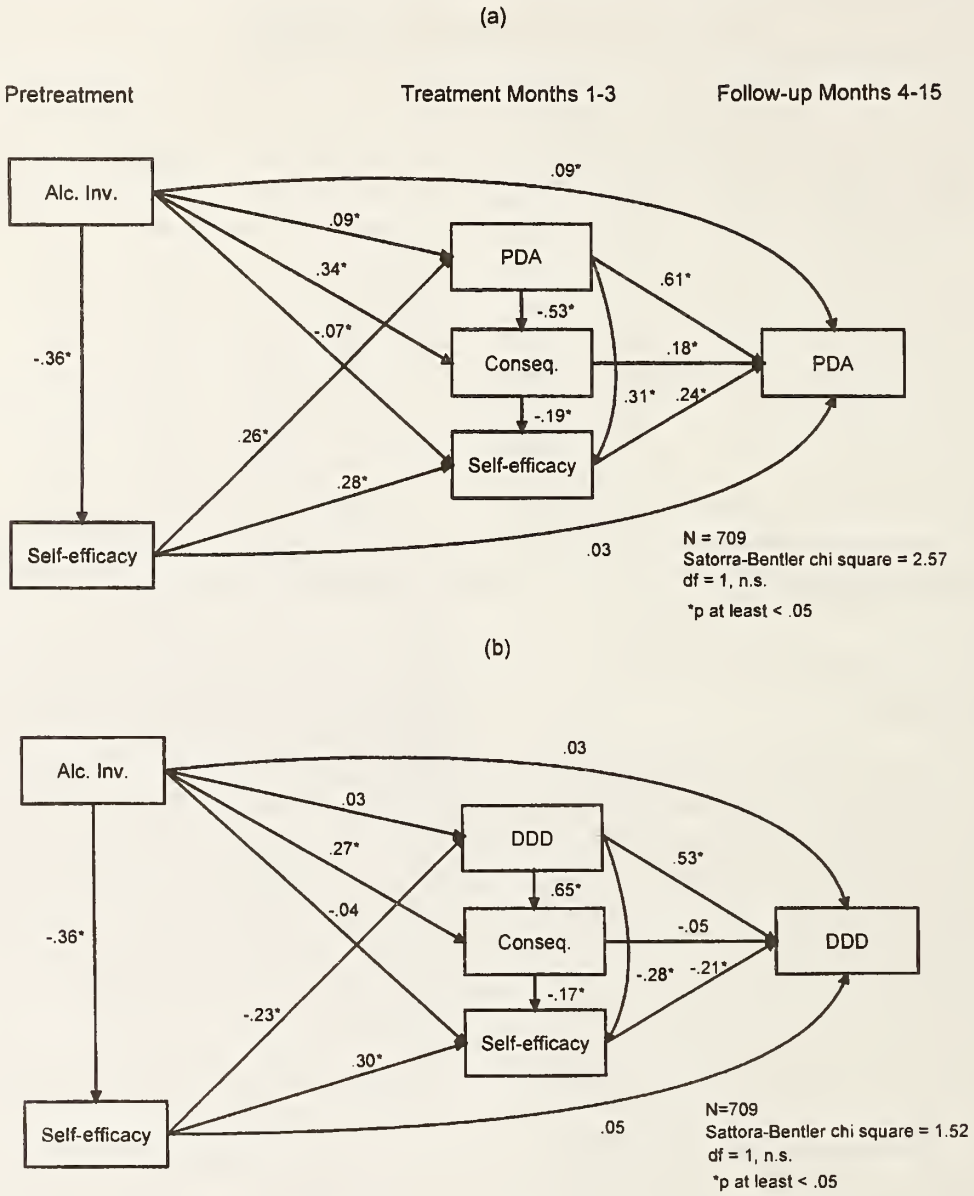

Figure 3. Outpatient alcohol involvement model applied to (*a*) percentage of days abstinent (PDA) and (*b*) drinks per drinking day (DDD).

Other indirect pathways were more consistent with the proposed model. Alcohol involvement was negatively associated with pretreatment self-efficacy. Pretreatment self-efficacy also was positively and significantly related to both within-treatment PDA and posttreatment self-efficacy. Pretreatment self-efficacy was not directly associated with posttreatment outcome. Posttreatment self-efficacy, however, was positively associated with posttreatment PDA. Moreover, as predicted, within-treatment PDA was negatively associated with within-treatment consequences, and both within-treatment drinking and consequences were associated with posttreatment self-efficacy in the predicted directions.

The alcohol involvement model applied to the DDD variable resulted in no significant direct effect of alcohol involvement. A significant positive indirect effect of alcohol involvement was found that was accounted for largely through alcohol involvement's negative effect on

Table 2. Decomposition of outpatient total and indirect alcohol involvement and treatment intensity effects for the alcohol involvement and treatment intensity models

Effect	Alcohol involvement model		Treatment intensity model	
	PDA	DDD	PDA	DDD
Total AI	.08*	.10*	.08*	.10*
Direct AI	.09*	.03	.09*	.03
Indirect AI	-.00	.07*	-.00	.07*
AI–SE1–SE2		.02		.02
AI–SE1–PDA/DDD		.04		.04
AI–Cons.–SE2		.01		.01
AI–SE1–PDA/DDD–SE2		.00		.00
AI–SE1–PDA/DDD–Cons.–SE2		.00		.00
AI–INT–PDA/DDD–SE2		NA		.00
AI–INT–PDA/DDD–Cons.–SE2		NA		.00
AI–INT–Cons.–SE2		NA		.00
Total treatment intensity			.22*	-.23*
Direct treatment intensity			NA	NA
Indirect treatment intensity			.22*	-.23*
INT–PDA/DDD			.23	-.21
INT–PDA/DDD–Cons.			-.03	ns
INT–PDA/DDD–Cons.–SE2			.01	-.01
INT–Cons.			-.02	ns
INT–Cons.–SE2			.01	-.00
INT–PDA/DDD–SE2			.03	-.02

NOTE: PDA=percentage of days abstinent; DDD=drinks per drinking day; AI=alcohol involvement; SE1=pretreatment self-efficacy; SE2=end of treatment self-efficacy; Cons.=within-treatment drinking consequences; INT=number of treatment sessions; ns=not significant; NA=not applicable (not included in the model). For significant indirect effects, only individual pathways in which all segments are significant are shown. Due to rounding and elimination of pathways with at least one nonsignificant segment, individual indirect pathway effects may not add up to total indirect effects. Significance level of individual pathways not computed. *$p<.01$

pretreatment self-efficacy, pretreatment self-efficacy's negative effect on within-treatment DDD, and the positive effect of within-treatment DDD on followup DDD. So, at least for the DDD variable, we found some support for our hypothesized indirect positive effect on outcome. It should be cautioned, however, that the causal model results vary somewhat from the main findings, which revealed no significant main effect of alcohol involvement on DDD. The different findings may reflect the absence of pretreatment DDD in the model. The pretreatment value of DDD was controlled for in the main trial analyses.

To summarize, our model appeared to fail in the outpatient arm because alcohol involvement was positively associated with PDA both within treatment and during the followup period. Also, negative consequences during treatment, contrary to our prediction, were positively associated with PDA posttreatment. Finally, the predicted indirect effects of alcohol involvement on PDA were not found. Some support for an indirect effect of alcohol involvement on DDD was found, but the observed effects occurred only when pretreatment DDD were not controlled for.

The Moderating Effects of Treatment Intensity

We subsequently examined the predicted moderating effects of treatment intensity on the alcohol involvement model (see figure 4). The direct and indirect effects of both alcohol involvement and number of sessions attended in this model are summarized in table 2. Consistent with our prediction, treatment intensity had a significant indirect effect on both followup PDA and DDD. This indirect effect was largely accounted for by the positive and negative effects of intensity, respectively, on PDA and DDD.

It is noteworthy, however, that two indirect pathways actually lowered the total overall effect of treatment intensity on followup PDA. Specifically, treatment intensity lowered within-treatment drinking consequences both directly and through its positive effect on within-treatment abstinent days. However, as noted earlier, consequences within treatment were associated positively with followup

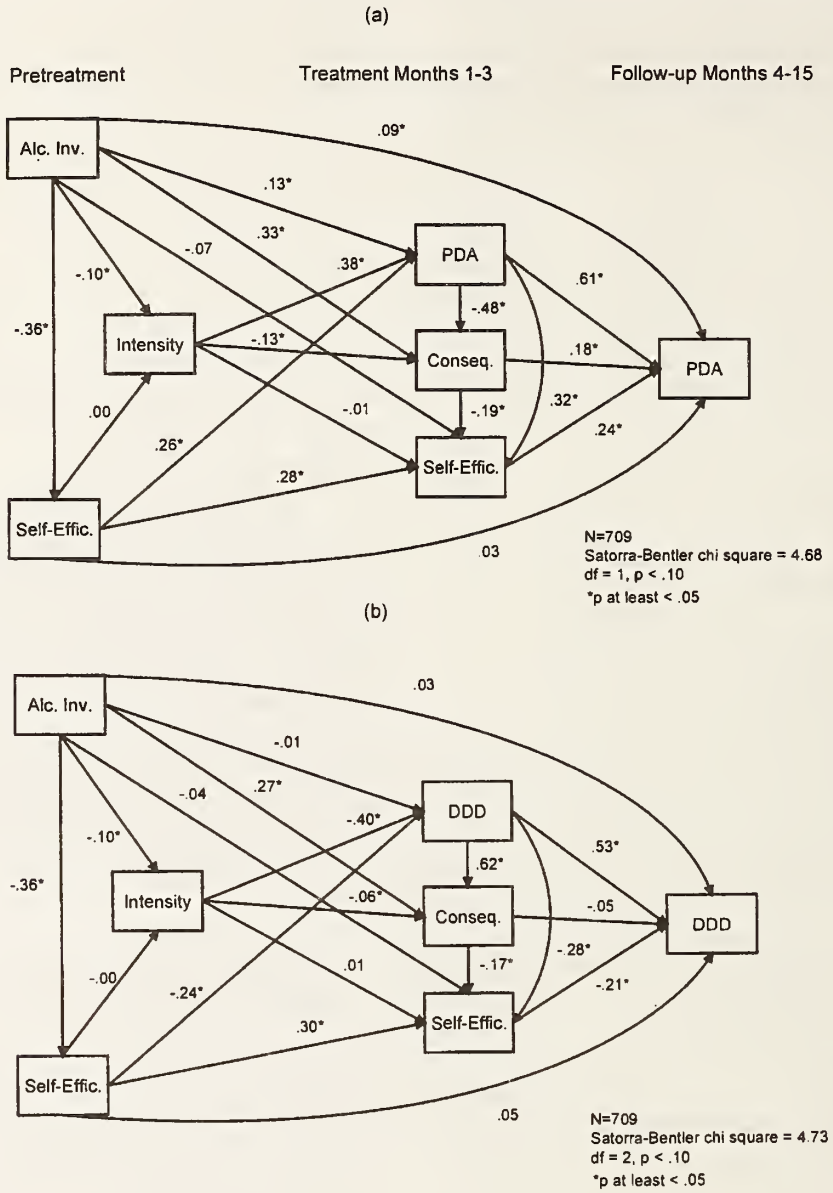

Figure 4. Outpatient treatment intensity model applied to (*a*) percentage of days abstinent (PDA) and (*b*) drinks per drinking day (DDD).

abstinent days. So, lowering consequences through more intense treatment caused a small decrement in the overall association between treatment intensity and abstinent days. In this case, within-treatment consequences appeared to moderate the treatment intensity effect.

No support was found for the predicted direct effect of treatment intensity on posttreatment self-efficacy. Also noteworthy is the support for the notion that treatment intensity influences outcome predominantly through indirect effects on within-treatment factors. This conclusion is exemplified in the fact that adequate model fit was obtained without a hypothesized direct effect of intensity on followup outcomes. Despite support for the role of treatment intensity in affecting outcome, there was no evidence of a moderating effect on alcohol involvement. Note in table 2, for example, that addition of treatment intensity effects to the alcohol involvement model did not alter either direct or indirect effects of alcohol involvement on outcome.

Moreover, as shown in figure 4, alcohol involvement was found to have a small negative effect on treatment intensity. Individuals high in alcohol involvement attended fewer sessions. This finding was not predicted and could have contributed further to our failure to find any moderating effect of treatment intensity.

Overall, except for a small negative effect of alcohol involvement on the number of sessions attended, alcohol involvement and number of sessions appear to function quite independently in influencing posttreatment drinking outcomes.

Exploratory Analyses

The models tested were averaged across the followup months to obtain followup drinking outcome measures. They did not take into account the changing relationship between alcohol involvement and outcome observed in the alcohol involvement by time interactions depicted in figure 2. As noted above, the increasing positive association between alcohol involvement and outcome across the followup period itself negated the proposed pathways hypothesized.

Two alternate pathways to account for the observed positive alcohol involvement-PDA relationship and its change over time subsequently were studied. It should be recalled that associations between alcohol involvement and outcome became more positive as the followup proceeded. To account for this finding, we first speculated that high alcohol-involved participants may have sought out more treatment within the first 6 months following the MATCH treatment and/or sought more affiliation with AA. We also speculated that high alcohol-involved clients may have been hospitalized or incarcerated more over this period. This higher level of involuntary abstinence and/or treatment-seeking behavior during followup could possibly account for the observed increase in the association between alcohol involvement and PDA as the followup period progressed. In other words, high alcohol-involved clients may have received more treatment over the period immediately following treatment to account for their better outcome later in the followup period.

The second potential pathway hypothesized that high alcohol-involved participants, because by definition they had experienced more negative consequences *before* treatment, may have been more motivated to change to begin with. This higher motivation also could counterbalance any negative effect of the severity of their problem on outcome.

To examine these two post hoc hypotheses, an exploratory path model, including both alternative pathways, was examined (figure 5). In this model, we studied the relationship between alcohol involvement and pretreatment readiness

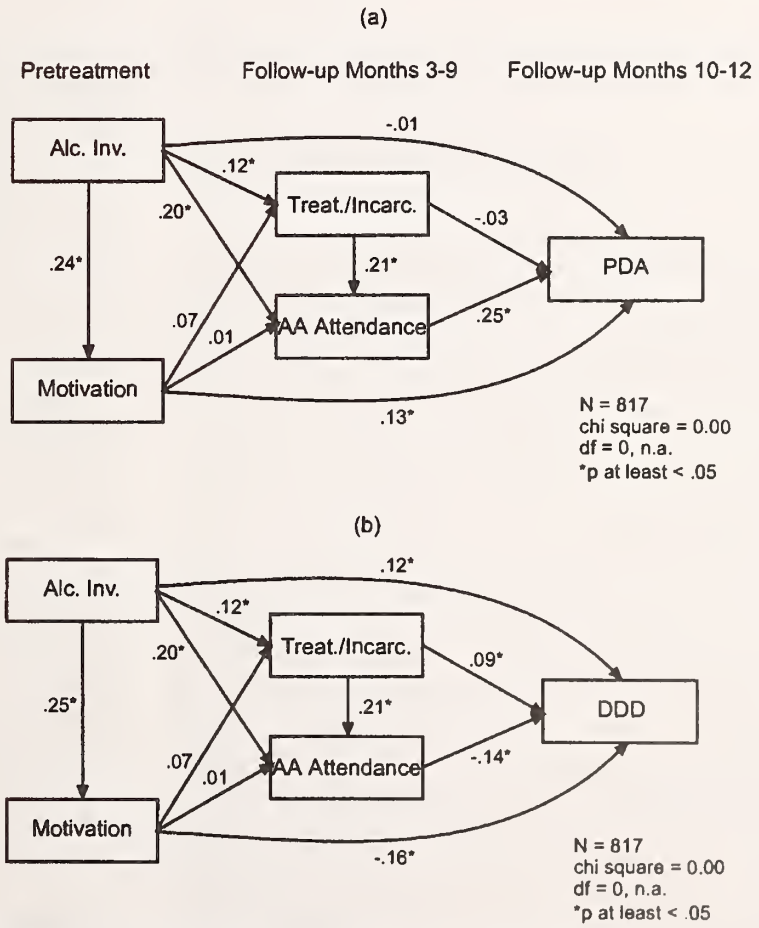

Figure 5. Outpatient exploratory model applied to (*a*) percentage of days abstinent (PDA) and (*b*) drinks per drinking day (DDD).

to change. In addition, the effects of alcohol involvement and readiness to change on subsequent treatment/incarceration and AA attendance in followup months 4–9 were examined. Finally, the direct and indirect effects of alcohol involvement, motivation, month 4–9 treatment/incarceration, and months 4–9 AA attendance on PDA during the subsequent 10- to 12-month period were assessed.

In this model, motivation to change was measured using the Readiness score derived from the University of Rhode Island Change Assessment Scale (DiClemente and Hughes 1990). AA involvement was a categorical variable (coded 1=yes, 0=no) indicating whether the individual had reported attending an AA meeting over the assessed period. Finally, since individual rates of subsequent treatment/incarceration episodes were relatively low across the MATCH sample and highly skewed, a composite measure of treatment/incarceration was used. This measure formed a dichotomous variable (coded 1=yes, 0=no) indicating whether an individual had been hospitalized, detoxified, or incarcerated; admitted to residential alcohol, drug, or psychiatric treatment; or received outpatient alcohol or drug treatment during the 4- to 9-month followup period.

To summarize, we hypothesized that the positive effect of alcohol involvement on 10- to 12-month drinking outcomes would be mediated by pretreatment motivation, AA attendance, and/or episodes of treatment/incarceration in months 4–9 immediately following treatment. Total, direct, and indirect effects are summarized in table 3.

Support was found for both pathways. Alcohol involvement had a significant indirect positive effect on both PDA and DDD. Moreover, this indirect relationship appeared mediated in large part by alcohol involvement's positive associations with both AA and motivation to change. Importantly, these pathways appeared to operate independently since there was no significant association between motivation and AA attendance. Alcohol involvement also was positively associated with subsequent treatment/incarceration, but the latter was not associated with subsequent outcome. Treatment/incarceration was associated positively with more AA attendance, but this pathway contributed only a small amount to the alcohol involvement indirect effect.

Table 3. Decomposition of total, direct, and indirect effects of exploratory model for outpatients

	PDA	DDD
Total	.08*	.06
Direct	-.01	.12*
Indirect	.09*	-.06*
AI–Treatment–AA	.01	-.00
AI–AA	.05	-.03
AI–Motivation	.03	-.04
AI–Treatment		.01

NOTE: PDA=percentage of days abstinent; DDD=drinks per drinking day; AI=alcohol involvement; Treatment=inpatient or outpatient treatment or incarceration. Only pathways with all significant sections are shown; significance of individual component indirect effects not shown.
*$p<.01$

Particularly noteworthy is that once the indirect effect of alcohol involvement on subsequent outcome was accounted for, its direct relationship with PDA became negative, consistent with our initial hypothesis. So, the positive relationship between alcohol involvement and PDA at followup may be at least partially mediated by alcohol involvement's positive associations with both pretreatment motivation and AA attendance in the first few months following the MATCH treatments.

A similar pattern was observed when the model was applied to the DDD variable, although here, as with the full model, alcohol involvement continued to have a significant direct effect on DDD during months 10–12. Again, however, the positive association between alcohol involvement and AA attendance and readiness to change appeared to buffer this effect, as noted in the reduced total effect on DDD.

Summary of Outpatient Arm Analyses

No significant alcohol by treatment interaction was observed in the outpatient arm. The a priori hypothesis failed, in part, because alcohol

involvement was unexpectedly associated with better overall outcome as the followup period progressed. The cause of this positive association with outcome appears to result from a tendency for high alcohol-involved clients to be more motivated initially and more likely to attend AA posttreatment. Together, these account for most of the observed positive total effect of alcohol involvement on PDA outcomes. Finally, although intensity of treatment did not moderate the effects of alcohol involvement, results suggested that its observed positive effect on outcome was mediated largely by its positive indirect effect on within-treatment outcome.

Aftercare Arm

Prognostic Effect of Alcohol Involvement

In the aftercare arm, alcohol involvement again showed no main effect or interaction with time on either dependent measure during the treatment period. There was, however, a significant main effect for alcohol involvement on both PDA, $F(1, 7678)=5.25$, $p=.02$, and DDD, $F(1, 7678)=6.71$, $p=.01$. In each case, the relationship was in the predicted direction, with alcohol involvement negatively associated with PDA and positively associated with DDD. For PDA, however, there was a significant alcohol involvement by quadratic time interaction, $F(1, 7678)=4.87$, $p=.03$.

This change in the relationship between alcohol involvement and PDA across followup is depicted in figure 6. From month 4 thru month 7, the relationship between alcohol involvement and PDA showed a near linear decrease from nonsignificant to significant negative association. The relationship then stabilized before becoming less negative in months 11–15. Although significant, it should be noted that these changes in relationship are small and remain negative throughout the period. The clinical relevance of this change over time is not clear.

Interaction of Alcohol Involvement With Treatment

Results of overall and individual contrast tests in the aftercare arm are presented in table 4. As in the outpatient arm, no significant interaction or individual contrast effects were observed.

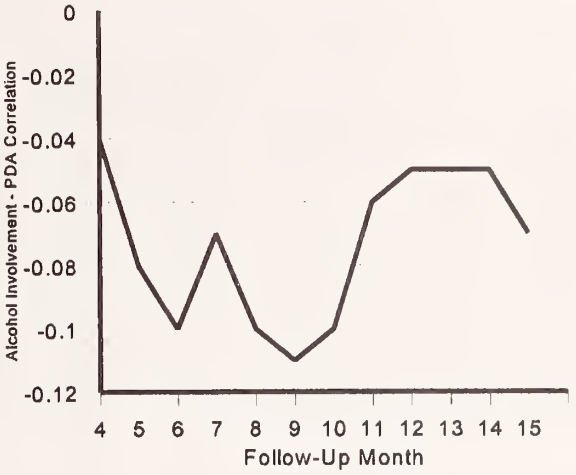

Figure 6. Partial correlations between pretreatment alcohol involvement and percentage of days abstinent (PDA) across followup months 4–15. Pretreatment PDA, clinical research unit, and treatment type are controlled for.

Examination of the Alcohol Involvement Causal Model

Figure 7 presents path analytic results for the alcohol involvement model. Table 5 summarizes alcohol involvement direct and indirect effects. There was no significant direct or indirect effect of alcohol involvement on PDA, although the effects were in the predicted direction. Contrary to our prediction, alcohol involvement was not significantly related to either within-treatment or followup PDA. Involvement was significantly and positively related to within-treatment consequences, but within-treatment consequences were not related directly to posttreatment drinking. Alcohol involvement at pretreatment did have a small but significant negative relationship with posttreatment self-efficacy, as had been predicted. Within-treatment PDA and posttreatment self-efficacy significantly predicted posttreatment PDA in the expected direction.

The model applied to DDD was in accord with predictions. Pretreatment alcohol involvement had both significant direct and indirect effects

Table 4. Alcohol involvement, aftercare

Treatment contrast		Within treatment						Posttreatment					
		Mv × Tx		Mv × Tx × T		MV × Tx × T^2		Mv × Tx		Mv × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD
CBT vs.	*F*	-.84	.50	-1.02	1.09	.27	-1.02	-.86	-.23	-.19	.55	-.93	.70
MET	*p*	.40	.62	.31	.28	.78	.31	.39	.82	.85	.58	.35	.49
CBT vs.	*F*	.08	-1.24	-.13	.87	-.27	1.51	.02	-.36	.61	-.59	.40	.17
TSF	*p*	.94	.22	.90	.39	.78	.13	.98	.72	.54	.55	.67	.86
MET vs.	*F*	.85	-1.65	.81	-.15	-.52	2.39	.81	-.14	.76	-1.07	1.26	-.47
TSF	*p*	.40	.10	.42	.88	.61	.02	.42	.89	.45	.28	.21	.64
MV × Tx	*F*	.48	1.43	.65	.69	.93	2.88	.47	.07	.31	.58	.85	.25
	p	.62	.24	.77	.50	.51	.06	.62	.93	.73	.56	.43	.78

NOTE: MV=matching variable, Alcohol Involvement; Tx =treatment; T=linear time; T^2=quadratic time; PDA=percentage of days abstinent; DDD=drinks per drinking day

Table 5. Decomposition of aftercare total and indirect alcohol involvement and treatment intensity effects for the alcohol involvement and treatment intensity models

Effect	Alcohol involvement model		Treatment intensity model	
	PDA	DDD	PDA	DDD
Total AI	-.10*	.28*	-.10*	.28*
Direct AI	-.06	.16*	-.06	.16*
Indirect AI	-.04	.13*	-.04	.13*
AI–SE1–SE2		.02		.02
AI–PDA/DDD		.05		.05
AI–PDA/DDD–Cons.–SE2		.00		.00
AI–SE2		.02		.02
AI–PDA/DDD–SE2		.01		.01
AI–Cons.–SE2		.01		.01

Effect	Treatment intensity model	
	PDA	DDD
Total treatment intensity	.20*	-.20*
Direct treatment intensity	NA	NA
Indirect treatment intensity	.20*	-.20*
INT–PDA/DDD	.17	-.13
INT–PDA/DDD–Cons.–SE2	.01	-.01
INT–SE2	.02	-.03
INT–Cons.–SE2	.00	-.00
INT–PDA/DDD–SE2	.01	-.02

NOTE: PDA=percentage of days abstinent; DDD=drinks per drinking day; AI=alcohol involvement; SE1=pretreatment self-efficacy; SE2=end of treatment self-efficacy; Cons.= within-treatment drinking consequences; NA= not applicable (not included in the model). For significant indirect effects, only individual pathway effects in which all segments are significant are shown. Due to rounding and the elimination of pathways with at least one nonsignificant segment, individual indirect pathway effects may not add up to total indirect effects. Significance level of individual pathways not computed.
*$p<.01$

on followup outcomes. Much of the effect was accounted for by the direct positive effect on DDD that was predicted. Only alcohol involvement's positive effect on within-treatment DDD appeared to contribute substantially to the positive indirect effect found on this measure.

The Moderating Effects of Treatment Intensity

Results of the path analysis on the treatment intensity model are presented in figure 8, and direct and indirect alcohol involvement and intensity effects are summarized in table 5. As in the outpatient arm, the addition of treatment sessions attended did not show any evidence of moderating the direct or indirect effects of alcohol involvement. Treatment intensity, however, did have a significant indirect effect. As with the outpatient arm, this effect was largely accounted for by the positive and negative effects, respectively, on PDA and DDD outcomes. Also, the model showed adequate overall fit without inclusion of a direct effect of intensity on outcome. As in the outpatient arm, the total effect

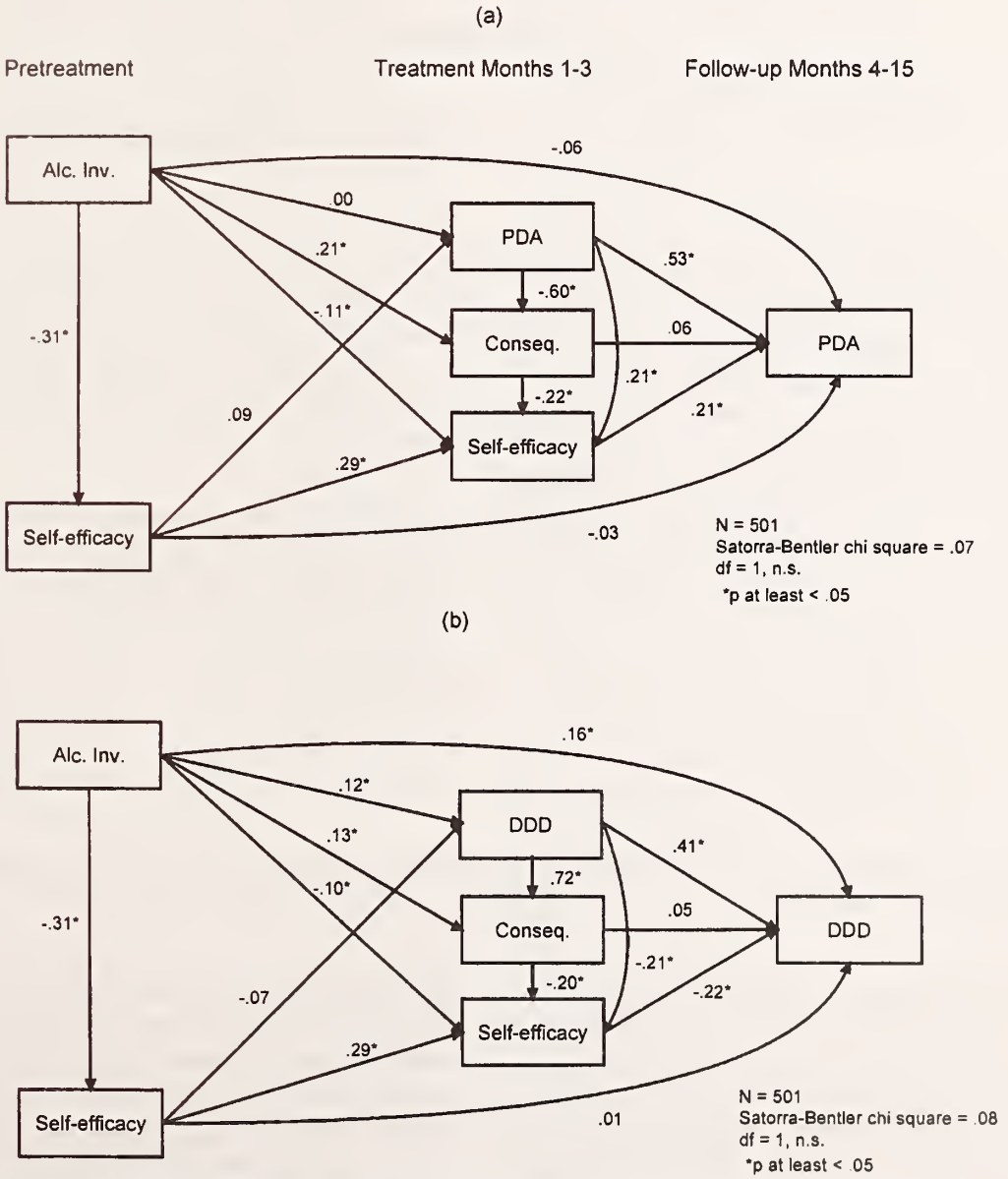

Figure 7. Aftercare alcohol involvement model applied to (*a*) percentage of days abstinent (PDA) and (*b*) drinks per drinking day (DDD).

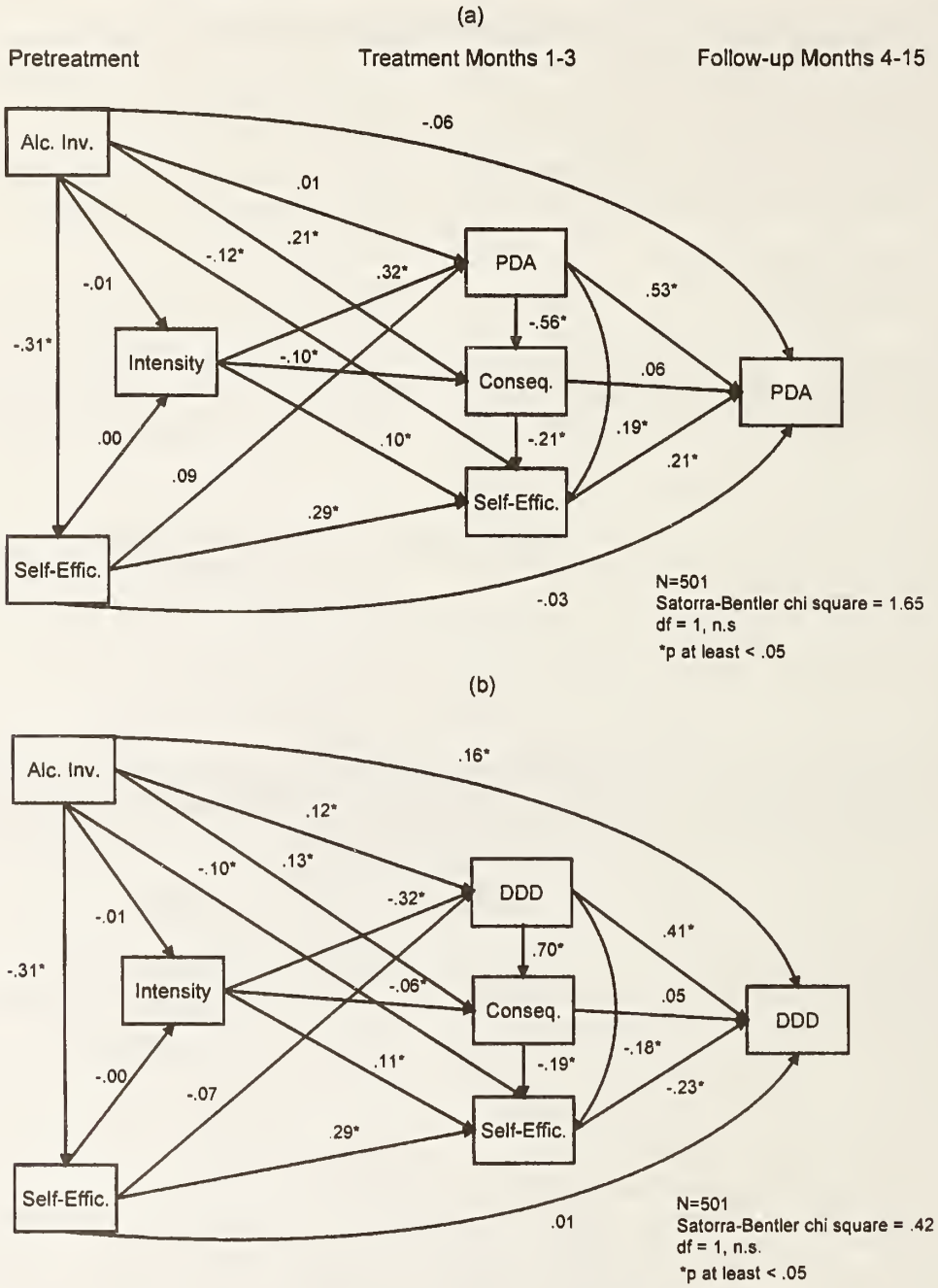

Figure 8. Aftercare treatment intensity model applied to (*a*) percentage of days abstinent (PDA) and (*b*) drinks per drinking day (DDD).

of treatment intensity on outcome appears largely accounted for by its indirect effects.

Summary of Aftercare Arm Findings

The alcohol involvement causal model applied to the aftercare sample more closely approximated that predicted than did the model applied to outpatients. No direct or indirect effect of alcohol involvement on PDA was found, possibly due to the curvilinear relationship between alcohol involvement and PDA across followup. Still, this relationship was in the predicted direction. As with the outpatient arm, however, there was no evidence of treatment intensity moderating alcohol involvement effects. Treatment intensity, however, did have a

predicted indirect effect on followup outcomes, largely through its positive effect on outcomes during treatment.

Discussion

The common belief that outpatients with high levels of alcohol involvement benefit most from more intense treatments was not supported in this study. The causal model analyses suggest a number of reasons for failure to support this predicted interaction. Foremost among these was the unanticipated finding that high alcohol-involved clients had relatively better outcomes as the followup period progressed. In this population, at least, it appears that individuals with high levels of alcohol involvement also are more ready to change and seek out AA more. These pathways appear to counteract any direct negative influence of alcohol involvement on outcome. The relationship between alcohol involvement and outcome in the aftercare arm was more consistent with our predictions. However, here too, the relationship between alcohol involvement and abstinent days was complex and varied in a curvilinear manner over the followup months.

Overall, the results suggest that the relationship between alcohol involvement and outcome as measured by abstinent days and DDD is complex, influenced by the tendency for high alcohol-involved subjects to seek out AA more in the ensuing months and to be more motivated for change in the first place. The AA findings highlight the importance of studying posttreatment factors and their influence on overall outcome (Moos et al. 1990).

It is important to note here that others also have failed to find a significant association between alcohol dependence/involvement measures and posttreatment abstinent days (Cooney et al. 1986). A more reliable finding was the consistent negative relationship between alcohol involvement and DDD in both the aftercare arm and, when other factors were not partialed out, in the outpatient arm. It would appear that alcohol involvement is more reliably associated with drinking intensity than drinking frequency measures.

The direction of other pathways in the causal model also were unanticipated and may have contributed to the failure of the proposed model, even in the aftercare arm where more predictions were confirmed. Specifically, we had not anticipated the negative association between alcohol involvement and number of sessions attended in the outpatient arm. While increased number of sessions is associated with better outcomes, the negative effect of alcohol involvement on sessions appears to attenuate this effect. Similarly, increased drinking consequences during treatment was associated with more abstinent days during followup among outpatients. In the aftercare arm, alcohol involvement continued to be associated negatively with posttreatment self-efficacy, also attenuating any positive effect of number of sessions on this measure.

In sum, the relationship between alcohol involvement and outcome appears to be influenced by the outcome measure assessed, client motivation, posttreatment help-seeking, and the population under study. In hindsight, the proposed hypothesis was too simple. Further exploratory analyses of secondary outcome measures and multiple predictor variables may elucidate the role of alcohol involvement, either alone or in conjunction with other measures, in predicting outcome and interacting with treatment type. It also may be that alcohol involvement interacts with the content and not the intensity of treatment to influence outcome.

In the preceding chapter (Cooney et al.), alcohol dependence was found to interact with treatment in a different manner than that predicted here. Unfortunately, although the alcohol involvement measure used in this analysis was highly correlated with that of Cooney and associates (0.69), we were unable to replicate their findings using the alcohol involvement measure or those portions of the measure more directly related to physical dependence symptoms.

Finally, it should be cautioned that the intensity of CBT and TSF treatments in MATCH was considerably less than that seen in intense outpatient or inpatient programs in the community. The possibility remains that the predicted interaction exists only when particularly high levels of treatment are involved. Similarly,

intensity and content of treatment were confounded in Project MATCH, such that content and intensity may have interacted in complex ways to negate the hypothesized interaction. Further exploration of these issues is needed.

Acknowledgments

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Part III: Psychological Dysfunction

Cognitive Impairment as a Client-Treatment Matching Hypothesis

Matching Clients to Alcoholism Treatment Based on Psychopathology

Sociopathy as a Client-Treatment Matching Variable

Alcoholic Typology as an Attribute for Matching Clients to Treatment

Cognitive Impairment as a Client-Treatment Matching Hypothesis

Dennis M. Donovan, Ph.D., Daniel R. Kivlahan, Ph.D., Ronald M. Kadden, Ph.D., and Dina Hill, Ph.D.

ABSTRACT

The present study investigated the role of cognitive impairment in drinking behavior during and following the three Project MATCH therapies. It was hypothesized that (1) more impaired clients would have poorer outcomes, (2) impaired clients in Cognitive-Behavioral Coping Skills Therapy (CBT) or Twelve Step Facilitation (TSF) would have better outcomes than those treated in Motivation Enhancement Therapy (MET), and (3) more impaired clients would have better outcomes in TSF than in CBT. The latter two hypothesized relationships represented anticipated matching effects between type of therapy and level of cognitive impairment. Level of impairment was not related to measures of drinking frequency or intensity in the outpatient arm of the trial as either a main effect or as an interaction with type of treatment. However, indirect evidence based on analyses of therapy attendance and completion, therapist-rated working alliance, and Alcoholics Anonymous (AA) involvement suggested that CBT may be less acceptable to more cognitively impaired individuals. Higher levels of AA involvement by the more impaired individuals were related to reduced drinking intensity during the active phase of therapy. Examination of the first causal chain suggested that the hypothesized therapy by impairment matching effect may have failed because the anticipated difference in therapeutic structure between MET and both CBT and TSF was not obtained. The second hypothesized causal chain was partially supported in that impairment level was related to dose of therapy received. In the aftercare arm, there was evidence of matching during the therapy delivery phase, with more impaired clients doing somewhat less well with respect to drinking behaviors in CBT than in TSF. However, these effects were relatively transitory, had disappeared by the end of treatment, and were not evidenced across the 1-year followup period. Examination of the causal chains indicated that the primary elements thought to underlie the observed interaction did not obtain; namely, the three therapies did not differ in their level of structure, and therapy dose did not interact with level of impairment. The results suggest that cognitive impairment, as measured in Project MATCH, is not related to treatment either as a prognostic variable or as a measure that would be useful for assigning individuals to one of the three Project MATCH therapies.

There is clear evidence that cognitive functioning is negatively affected by long-term abusive drinking. Cognitive functioning refers to those intellectual capacities, both learned and innate, that allow individuals to understand and interact adaptively with their environment. There is a high prevalence of impairment of such adaptive abilities among

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detoxified alcoholics, suggesting that the observed deficits are more than just the aftereffects of acute intoxication. From 50 to 80 percent of alcoholics have been found to be significantly more impaired than appropriately matched nonalcoholic control clients (Parsons 1986). It is assumed that such impairments affect treatment process and outcome among alcoholics.

Rationale for the Matching Hypothesis

Cognitive Impairment and the Treatment Process

Alcoholics early in treatment show significant deficits in learning ability (e.g., Goldman 1987) and have difficulty acquiring and remembering treatment-relevant information (Becker and Jaffe 1984; Godding et al. 1992; Roehrich and Goldman 1993). The degree of difficulty in handling information appears to be related to the level of recent heavy drinking and possibly to the level of cognitive impairment experienced by the individual (Alterman et al. 1989; Godding et al. 1992; Sanchez-Craig et al. 1987).

Alcoholics with higher levels of assessed impairment in problem-solving and adaptive abilities have been rated by therapists (blind to the clients' neuropsychological test scores) as having higher levels of psychological distress; as being less able to generalize information, reason, and generate future plans; as participating less in therapy groups; as having functioned less adaptively in treatment; and as showing less clinical improvement over the course of treatment (Fals-Stewart et al. 1995; Kupke and O'Brien 1985; Leber et al. 1985; O'Leary et al. 1979; Parsons 1987). Smith and McCrady (1991) also found that alcoholics who had more impaired abstracting and conceptual abilities had more difficulties in acquiring drink-refusal skills than did those with higher levels of functioning. Alcoholics with greater levels of impairment are significantly less likely to complete inpatient treatment (O'Leary et al. 1979) and are predicted by inpatient therapists as likely to have poor prognoses at 1-year posttreatment (Leber et al. 1985).

In order to benefit from alcoholism rehabilitation, one must be capable of receiving new information, integrating it with existing stores, and translating this input into behavioral changes (Goldman 1983). The prerequisite cognitive competencies involved in this therapeutic process, particularly attention capacity, cognitive flexibility, and abstract reasoning, are often found to be impaired in alcoholics (McCrady and Smith 1986). It has been suggested that standard treatment programs are too fast paced, require attentional and memory skills that are often beyond the capabilities of the patients, and employ materials that are too abstract conceptually for the patient to absorb, process, generalize, and apply (McCrady 1987).

Treatment programs may need to be modified to deal more effectively with cognitively impaired alcoholics (Donovan and Chaney 1985; Gordon et al. 1988; McCrady 1987; McCrady and Smith 1986). Rather than insight-oriented therapy that may require more verbally mediated abstracting and conceptual ability than the individual is capable of, more structured interventions focusing on the development and rehearsal of social and behavioral coping skills have been recommended (Clifford 1986; Donovan and Chaney 1985). Such a therapeutic approach would focus on the development of coping skills and the prevention of relapse (Chaney 1989; Monti et al. 1989; Marlatt and Gordon 1985), with an emphasis on the use of modeling, role playing, behavioral rehearsal of, and performance feedback about coping attempts.

Despite the strong intuitive appeal of structured treatment approaches for cognitively impaired alcohol abusers, this hypothesis has not been directly tested. Smith and McCrady (1991) and Roehrich and Goldman (1993) demonstrated that cognitively impaired alcoholics have difficulty acquiring knowledge and behavioral skills that would help prevent relapse. Sanchez-Craig and associates (1987) found that alcoholic clients tended to forget coping strategies within a month of completing treatment, despite evidence that they had mastered these strategies during treatment. It was suggested that impairment of the cognitive abilities needed to learn, remember, and use such new skills may mitigate against the use of cognitively mediated treatment strategies

among impaired individuals. Thus, questions remain about the appropriateness and relative efficacy of cognitive-behavioral approaches with impaired alcoholics.

Cognitive Impairment and Treatment Outcome

The level of cognitive impairment also appears to be predictive of treatment outcome among alcoholics. Alcoholics who were more impaired at the beginning of treatment had poorer outcomes with respect to subsequent drinking behaviors and other aspects of psychosocial adjustment such as employment status (e.g., Donovan et al. 1985; Walker et al. 1983). Parsons, Schaffer, and Glenn (1990) found that alcoholics who had relapsed during a 14-month posttreatment followup period performed significantly more poorly at the beginning of treatment on a global index of neuropsychological performance than did those who had abstained during followup.

Similarly, Sussman and associates (1986) found that nearly 75 percent of alcoholics who recalled less than half the items on an ecologically relevant memory test (i.e., one that involved the recall of familiar stimuli such as products found in markets) at intake to treatment had relapsed by 3 months posttreatment; only a third of clients who had recalled more than half the items on this test had relapsed.

While these results appear promising, there are exceptions to this pattern (e.g., Lennane 1988; Macciocchi et al. 1989), and there is considerable variability in the relative strength of the association between cognitive impairment and treatment outcome when it is found (e.g., Donovan et al. 1984; Eckardt et al. 1988; Glenn and Parsons 1991; Parsons et al. 1990; Wilkinson and Sanchez-Craig 1981).

Cognitive Impairment and Matching With Treatment

Kadden and associates (1989) found a suggestive interaction effect on treatment outcome between level of cognitive impairment among alcoholics and the type of treatment received as aftercare following an inpatient alcohol rehabilitation program. Cognitively impaired alcoholics had better drinking outcomes following involvement in supportive interactional group therapy, while unimpaired clients had better outcomes in a cognitive-behavioral coping skills group. It was suggested that the focus on training a broad range of skills and the reliance on homework assignments in the coping skills group may have overwhelmed the impaired clients; such individuals may have felt more supported and less cognitively taxed in the interactional groups which emphasized interpersonal relationships.

Jaffe and colleagues (1996) provided additional findings about the role of treatment structure versus support, with cognitively impaired alcoholics receiving one of two types of outpatient psychotherapy. Those with lower levels of verbal learning had poorer drinking outcomes when receiving relapse prevention versus supportive therapy. Higher levels of verbal learning, on the other hand, were associated with better outcomes in relapse prevention than in supportive therapy.

Statement of the Hypotheses

Hypothesized Main Effect

Previous results suggest that those individuals with greater cognitive impairment will have poorer outcomes across a variety of outcome measures than those with less impairment.

Thus, it was hypothesized that individuals with greater cognitive impairment, measured along a continuum, will have poorer outcomes, regardless of type of treatment, than those with less impairment.

Hypothesized Interaction Effects

Structure, Intensity, and Duration

The first hypothesized interaction effects were based on the apparent differences in the level of structure, intensity, and duration of the MATCH treatments. Some findings suggest that more cognitively impaired alcoholics should do better in more structured/intensive or longer treatments than in therapies with less structure or shorter durations. Those with minimal impairment would be expected to do comparably in either form of treatment. Twelve Step Facilitation (TSF; Nowinski et al. 1992) and

Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992) were assumed to be more structured and were scheduled to have more sessions than Motivational Enhancement Therapy (MET; Miller et al. 1992) and were thus expected to lead to better outcomes for more cognitively impaired individuals.

Thus, it was hypothesized that alcoholics who are more cognitively impaired will have better outcomes, defined by percentage of days abstinent (PDA) and drinks per drinking day (DDD), following either CBT or TSF than following MET relative to clients who are less cognitively impaired.

Two measures were used to investigate this hypothesis. The first, the degree of therapeutic structure of each of the interventions, was operationalized using ratings of the Project MATCH Tape Rating Scale. This scale (Carroll et al. 1998) involved raters blind to the therapy condition rating videotapes of therapy sessions on a number of dimensions. These included dimensions, based on ratings of therapists' activities and interventions, that were defined by factor analysis as being relatively specific to each of the three Project MATCH therapies. The therapeutic structure scale appeared to cut across therapies and was defined by items such as therapists' level of verbal activity, the consistency of therapeutic focus over the course of a session, continuity of therapeutic theme from previous session, and a global rating of structure.

The second set of measures involved the intensity of treatments received (versus scheduled) as defined by indices of therapy attendance. These indices included the number of sessions attended, the percentage of scheduled sessions attended, the percentage of clients who attended three or more therapy sessions, and the percentage of clients who attended all scheduled sessions (e.g., therapy completers). These two causal chains are presented graphically in figures 1 and 2.

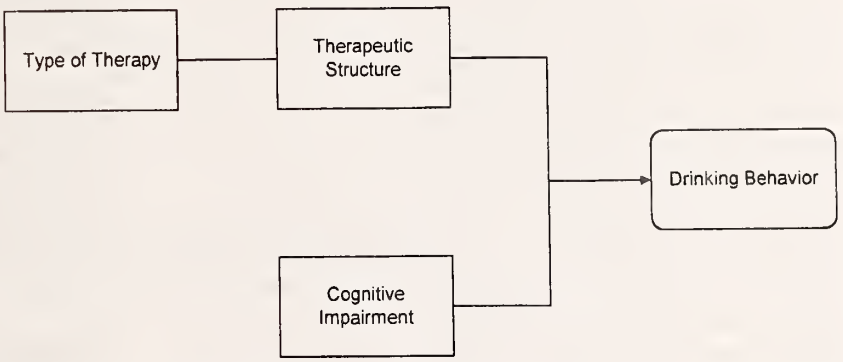

Figure 1. Cognitive impairment hypothesis: CBT versus MET as a function of therapeutic structure.

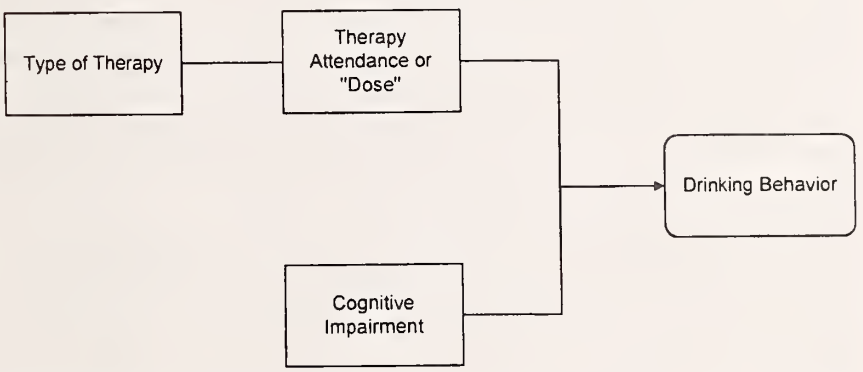

Figure 2. Cognitive impairment hypothesis: CBT versus MET as a function of therapy attendance or dose.

Content, Support, and Cognitive Complexity

The second anticipated interaction was based on differences in the content of therapies, level of support, and cognitive complexity between therapies having comparable levels of intensity and duration. More impaired clients could be predicted to derive greater benefit from either CBT therapy, with its emphasis on training of concrete skills and behavioral rehearsal of them, or TSF, with its straightforward, often repeated messages (e.g., Alcoholics Anonymous (AA) "slogans") that appear to provide simpler, more concrete advice to compensate for cognitive impairment (see Gordon et al. 1988), and

the social support of AA meetings which clients are encouraged to attend.

However, the treatment outcome results of Kadden and associates (1989) and Jaffe and colleagues (1996) suggested that more impaired alcoholics have poorer outcomes in cognitive-behavioral treatments, and additional treatment process evidence indicated that more impaired alcoholics have greater difficulty acquiring knowledge and behavioral skills associated with coping skills (Roehrich and Goldman 1993; Smith and McCrady 1991).

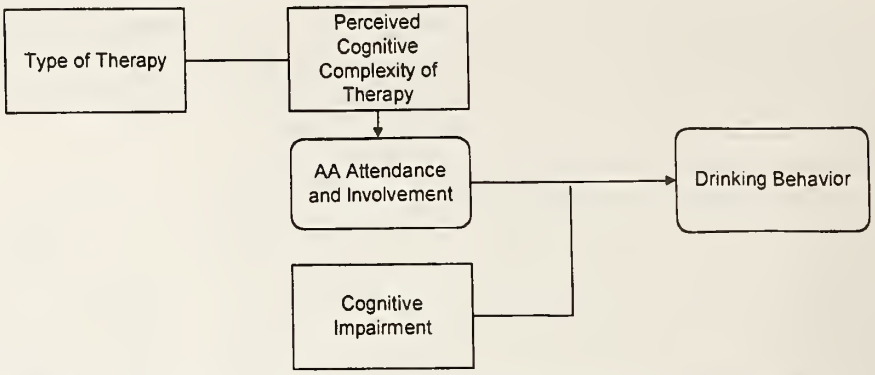

Figure 3. Cognitive impairment hypothesis: CBT versus MET as a function of perceived complexity of the therapy, with AA attendance and involvement serving as proxies.

Thus, it was hypothesized that cognitively impaired alcoholics will have better outcomes, defined by PDA and DDD, following TSF than following CBT relative to clients who are less cognitively impaired.

The CBT manual states that the role of the client is one of active participation in the learning of skills for coping with high-risk drinking situations, managing thoughts about alcohol and drinking, problem-solving, refusing drinks, planning for emergencies, coping with lapses, and managing interpersonal and intrapersonal discomfort. These skills are quite complex and typically unfamiliar to many clients. In contrast, the TSF message is less complex, focused on the AA ideas of acceptance, surrender, and getting active. The latter involves social activities of the AA Fellowship through which one might gain additional support.

Given the added assumption about the importance of participation in AA activities for the 12-step clients, the number of AA meetings attended for both CBT and TSF was tracked. Unfortunately, the ratings of videotaped sessions did not include measures that would directly assess the purported differential levels of cognitive complexity associated with the CBT and TSF conditions. In the absence of ratings of the complexity of the therapy sessions, complexity of treatment was indexed by proxy through AA meeting attendance and AA involvement as an indication of additional low complexity treatment. This hypothesized causal chain is presented graphically in figure 3.

Operationalization of the Matching Variable

Three relatively brief measures of cognitive function and impairment were included in the Project MATCH assessment protocol: the Shipley Institute of Living Scale (Shipley 1940), the Trail Making Test, Parts A and B (Reitan 1958), and the Symbol Digit Modalities Test (Smith 1973). These measures have been found to be useful in differentiating alcoholics who learn and retain treatment-relevant information from those who do not; have been shown to be related to therapists' ratings of clinical treatment process, progress, and prognosis; and have demonstrated some utility in predicting outcome.

A principal components analysis was conducted using the Trails B, the Symbol Digit Modalities Test, and the Shipley Abstraction T-scores from the 1726 clients from Project MATCH. A single principal component emerged (eigenvalue=1.94), accounting for 64.6 percent of the variance. The component matrix suggested that all three measures loaded highly on this factor (Abstraction T-score=0.76; Trails B total time=-0.83; Symbol Digit=0.82).

Based on these preliminary analyses, it was decided to use a single composite measure, the Cognitive Impairment Index, derived by summing the unit-weighted standardized scores for the Trails B total time, Symbol Digit Modalities Test (number of correct responses in 90 seconds), and the T-score from the Shipley Abstraction scale (Trails B – Abstraction – Symbol Digit). Higher positive scores on this index

indicate higher levels of impairment; lower and negative scores indicate less impairment. Information concerning the distributional properties of this index and the relationship of three levels of impairment (based on a trichotomy of the distribution for the entire sample) to other measures of cognitive function for the total sample and the outpatient and aftercare arms of the trial are presented in table 1. Based upon the scores on other measures of cognitive function, the derived levels of cognitive impairment appear better at accurately classifying clients in the outpatient arm than in the aftercare arm of the trial.

Results: Outpatient Arm

Tests for Prognostic and Matching Effects

The primary analyses investigating prognostic main effects and matching interaction effects employed latent growth procedures as outlined in the overall Project MATCH data analysis plan (Project MATCH Research Group 1997; Longabaugh and Wirtz, this volume, pp. 4–17). Cognitive impairment index scores, the three treatment conditions (CBT, MET, and TSF), and the impairment by treatment interaction effects were the independent variables, and PDA and DDD across time were the dependent variables. These analyses also included covar- iate adjustments to control for extraneous variables. The covariate set included the baseline measure of the drinking outcome criterion being used in an analysis, terms for site main effects and site by treatment interaction effects, terms for site by matching variable interactions, and interaction terms for both linear and quadratic time for each of these covariates.

Analyses were conducted to determine the prognostic effects of the cognitive impairment index with respect to PDA and DDD in the outpatient arm of the trial. Cognitive impairment was not predictive of treatment outcome (no

Table 1. Characteristics of the Cognitive Impairment Index and its relationship to other measures of cognitive function

	Outpatient				Aftercare			
Measure	Low	Medium	High	Total	Low	Medium	High	Total
Cognitive Impairment Index								
Mean	-2.42	-0.32	2.37	-0.47	-2.31	-.34	2.90	.56
SD	.90	.59	1.49	2.13	.81	.57	1.92	2.57
Shipley Abstraction T Score[a]	60	55	46	55	54	53	52	54
Shipley Vocabulary T-Score[a]	54	51	46	51	50	49	49	49
Shipley Total T-Score[a]	58	53	45	53	52	51	50	51
Shipley Abstraction Quotient	108	102	93	102	101	102	100	101
Shipley Conceptual Quotient	101	91	79	92	88	89	86	88
WAIS Equivalent IQ	108	100	90	101	99	98	96	97
Trails A (time in seconds)	27	30	37	31	36	35	39	37
Percent impaired[b]	9.7%	14.0%	38.0%	18.2%	29.1%	29.5	36.8%	32.6%
Trails B (time in seconds)	57	70	102	73	87	85	91	88
Percent impaired[c]	5.4%	14.3%	47.1%	19.0%	30.7%	31.8%	37.1	35.4%
Symbol Digit Substitution (number correct in 90 sec)	56	49	43	51	46	47	45	46
Percent impaired[d]	5.6%	18.5%	52.9%	22.1%	36.7%	37.2%	42.9%	37.6%

NOTE: [a] T-Scores are age adjusted and have a mean of 50 and standard deviation of 10; [b] 41 seconds or more is in the impaired range; [c] 91 seconds or more is in the impaired range; [d] Equal to or less than 1.5 *SD* from the age-adjusted normative mean is in the impaired range (Lezak 1983).

main effect for cognitive impairment) during months 1–3 when the treatments were being delivered or across the 1-year followup period (months 4–15). Similarly, no statistically significant interactions were found between degree of impairment and type of therapy to suggest a matching effect on either the PDA or DDD outcomes during the 1–3 or 4–15 month periods (table 2). Subsequent analyses of outpatients followed at months 37 to 39 similarly found no evidence of prognostic main effects for cognitive impairment or matching interaction effects between level of impairment and type of therapy (Project MATCH Research Group 1998).

CBT Versus MET and TSF Versus MET Contrasts

Therapy Structure

An initial question in relation to the hypothesized causal chain is whether the TSF and CBT therapies were comparable in their level of structure within sessions and had greater structure than MET. A second and related question is whether the levels of structure of the three therapies differ for clients having different levels of cognitive impairment. That is, do individuals who are impaired seem to "pull" for more structure in therapy than do less impaired clients? To address these questions, a factorial analysis of variance (ANOVA) was conducted for each arm of the trial, with the three therapy conditions and three levels of cognitive impairment (based on trichotomization of the clinical impairment index distribution) as the independent variables and level of structure derived from the Project MATCH Tape Rating Scale as the dependent variable.

No differences were found in rated structure across level of cognitive impairment (F=0.176, p=.84), nor was there a significant interaction between cognitive impairment and type of therapy (F=0.788, p=.533). However, a significant difference (F=3.024, p=.049) was found in the level of structure across the three types of therapy. Subsequent Duncan's paired comparisons (p=.05) indicated that the level of structure of CBT (16.35) was significantly less than MET (17.07); TSF (16.74) was comparable to both CBT and MET in level of structure. Thus, a major underlying assumption of the first hypothesis and causal chain failed to be supported in the outpatient arm of the trial; the level of structure within MET sessions was equal to or greater than that found for the TSF and CBT therapies.

Therapy Attendance and Treatment Dose

Sessions Attended. A second question was whether the three therapies differed with respect to the dose of treatment clients received. A factorial ANOVA was conducted within each arm of the trial, with number of treatment sessions attended serving as the dependent variable and the type of therapies and level of

Table 2. Cognitive Impairment, outpatient

Treatment contrast		Within treatment						Posttreatment					
		MV × Tx		MV × Tx × T		MV × Tx × T²		MV × Tx		MV × Tx × T		MV × Tx × T²	
		PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD
CBT vs. MET	*F*	-.21	.89	-.15	.09	.10	-.40	.20	-.33	1.00	-.91	.20	.24
	p	.83	.37	.88	.93	.92	.69	.84	.74	.32	.37	.84	.81
CBT vs. TSF	*F*	-.16	1.41	.19	-.21	-.27	1.20	.26	.16	.61	-1.25	1.37	-1.08
	p	.87	.16	.85	.83	.79	.23	.79	.87	.54	.21	.17	.28
MET vs. TSF	*F*	.06	.52	.34	-.30	-.36	1.59	.06	.48	-.38	-.33	1.14	-1.30
	p	.95	.60	.74	.76	.72	.11	.95	.63	.70	.74	.26	.19
MV × Tx	*F*	.03	1.02	.05	.05	.07	1.36	.04	.12	.51	.84	1.07	.96
	p	.98	.36	.96	.95	.93	.26	.96	.89	.60	.43	.34	.38

NOTE: MV=matching variable, Cognitive Impairment; Tx=therapy condition; T=time; T^2=quadratic time; PDA=percentage of days abstinent; DDD=drinks per drinking day

cognitive impairment serving as the independent variables. In the outpatient arm, as predicted, clients in MET (3.26 sessions) attended significantly fewer therapy sessions (F=193.21, p=.000) than those in either CBT (8.12 sessions) or TSF (7.51 sessions). However, CBT and TSF also differed significantly, a result that was not consistent with the causal chain assumption of these two therapies being equal in attendance. Although the overall differences across cognitive impairment levels failed to reach significance (F=2.533, p=.08), subsequent post hoc analyses indicated that the low impairment group (6.58 sessions) differed (p=.05) from the high impairment group (6.00 sessions).

There was also a significant therapy by cognitive impairment interaction (F=3.283, p=.011). This appears to be due to a significant difference within the CBT condition in the attendance among the high impairment group (6.97 sessions) and the level of attendance by the low (8.88 sessions) and medium (8.52 sessions) impairment groups, and in comparison to the pattern of attendance across the MET and TSF conditions. Thus, as anticipated, therapies differed in session attendance/treatment dose. However, TSF was found to involve nearly one session less than CBT, although the causal chain was predicated on these two being equivalent. Also, outpatient clients in the high impairment group attended fewer CBT sessions than did those in the medium and low impairment groups (figure 4).

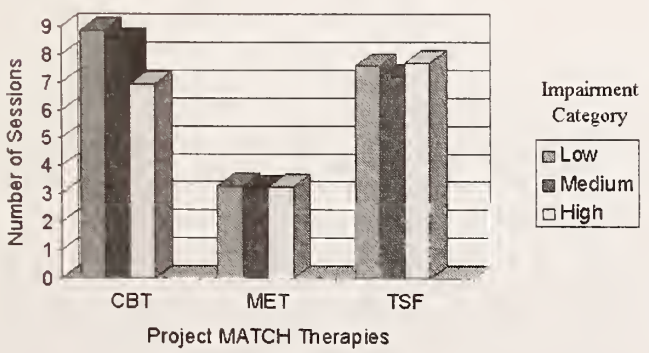

Figure 4. Number of outpatient therapy sessions attended as a function of type of therapy and level of cognitive impairment.

Percentage of Sessions Attended. The relationship of cognitive impairment to attendance was explored further by examining the percentage of sessions attended across levels of impairment. Factorial ANOVAs were conducted for each arm of the study with percentage of sessions attended as the dependent variable and type of therapy and level of cognitive impairment as the independent variables. In the outpatient arm, a significant effect was found for the type of therapy, with MET (81.49 percent) having a higher percentage of sessions completed than either CBT (67.7 percent) or TSF (62.59 percent) (F=28.64, p=.000).

There were no differences in percentage of sessions attended as a function of level of cognitive impairment (F=2.158, p=.116); however, the interaction between type of therapy and impairment approached significance (F=2.369, p=.051). This appears related to the large falloff in percentage of sessions attended by highly impaired clients in the CBT condition (58.1 percent) compared with those in the medium impairment (71.0 percent) or low impairment (74.0 percent) group, and in comparison to the consistent pattern of attendance found across levels of impairment in the MET and TSF groups (figure 5).

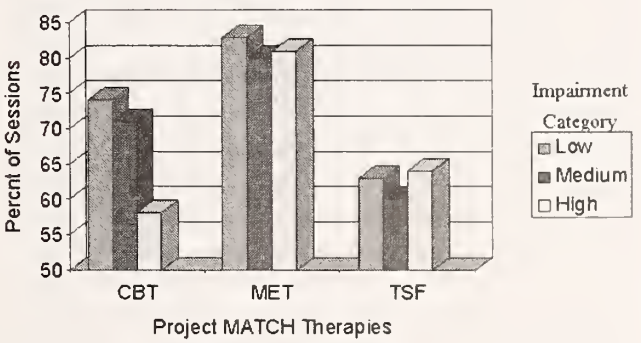

Figure 5. Percentage of outpatient sessions attended as a function of type of therapy and level of cognitive impairment.

Categorical Attendance Indices. A final method to analyze the relation of impairment to attendance was to examine two variables categorizing therapy attendance. The first classified clients having attended 0–2 sessions as low attendees (17.4 percent in outpatient) and those having attended 3 or more sessions as high attendees. This cutoff coincides with the fact that

all three interventions presented their first two therapy sessions in the same timeframe, namely, during the first 2 weeks of treatment. The second variable classified those having attended 100 percent of scheduled therapy sessions as therapy completers (37 percent of total outpatient sample and 44.8 percent of those attending 3 or more outpatient sessions), while those with less than 100-percent attendance were classified as noncompleters.

These data were analyzed using a 2×3 chi-square analysis. No significant relationship was found in the outpatient arm on the level of attendance; however, the chi square for complete/noncomplete approached significance (X^2= 5.763, p=.056). This latter value suggested a trend in which only 32.8 percent of clients in the high impairment group completed therapy compared to 41.6 percent and 34.9 percent, respectively, for the low and medium impairment groups

When the type of therapy was factored into multilevel chi-square analyses, a significant relationship was found for the CBT condition in the outpatient arm for both the level of attendance (X^2=6.970, p=.031) and therapy completion status (X^2=8.585, p=.014). These relationships appear attributable to the higher percentage of clients in the high impairment group who were classified as low therapy attendees (22.1 percent) and noncompleters (83.1 percent) compared to the low (9.6 percent low attendees, 64.5 percent noncompleters) and medium (11.1 percent low attendees, 75 percent noncompleters) impairment groups. The relationship of attendance and impairment within CBT for the outpatient sample is depicted in figure 6.

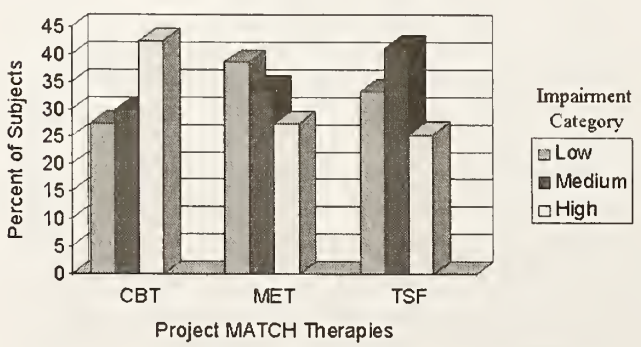

Figure 6. Percentage of outpatients classified as low attenders (≤2 sessions) as a function of type of therapy and level of cognitive impairment.

Working Alliance. Although not part of the original causal chain, another possible process measure with which cognitive impairment might interact is the development of a working alliance during the course of treatment. The Working Alliance Inventory (WAI; Horvath and Greenberg 1986) was completed by both clients and therapists after the second therapy session. Univariate factorial ANOVAs with the therapist- and client-rated WAI total scores, with level of impairment and type of therapy as independent variables, were conducted in each arm of the study.

No differences or interactions were found on the client-rated WAI total score. A significant effect was found on therapist-rated WAI total scores as a function of type of therapy (F=3.777, p=.023) and level of impairment (F=3.176, p=.042); however, there was no significant therapy by cognitive impairment interaction effect. The therapy group difference is related to the TSF having a significantly higher WAI-therapist total score (199.35) than the CBT group (193.43); no differences were found between MET (196.94) and either the TSF or CBT groups. The impairment main effect is accounted for by the high impairment group (193.48) being significantly lower than the low impairment group (199.43); there were no differences between the medium impairment group (195.79) and either the low or high impairment groups.

The Bond, Goals, and Task subscale scores from the WAI were entered into multivariate analyses of variance (MANOVA) as the dependent variables, with level of cognitive impairment and type of therapy as the independent variables. There were no multivariate differences among outpatients on the client-rated WAI subscales as a function of level of cognitive impairment (Pillai's=0.002, F=0.232, p=.966) or its interaction with type of therapy (Pillai's= 0.022, F=1.433, p=.143); there was, however, a significant difference as a function of type of therapy (Pillai's=0.02, F=2.577, p=.017). This appears to be accounted for by differences across therapy conditions on the Bond subscale (F=4.818, p=.008), in which MET (72.08) had a significantly higher score than either the CBT (69.65) or TSF (70.34) groups, which did not differ from one another.

There were no significant differences in the outpatient arm on the therapist-rated WAI subscale scores as a function of the type of therapy or its interaction with level of impairment; while not significantly different (Pillai's=0.014, F=1.811, p=.093), the level of impairment approached this level. Univariate ANOVAs conducted as part of the MANOVA process to test between-client effects found a significant difference as a function of level of impairment on the Task subscale (F=3.528, p=.03) and an interaction effect on the Bond scale (F=2.50, p=.041). The interaction appears to be accounted for by the high impairment group's Bond score (63.34) in the CBT condition in contrast to that of the low (67.68) and medium (66.68) impairment groups and in comparison to the pattern of scores in the other therapy conditions (figure7).

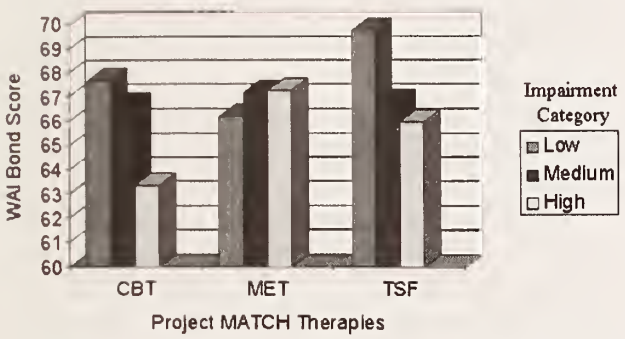

Figure 7. Therapist ratings of therapeutic bond in outpatient therapies as a function of level of cognitive impairment.

CBT Versus TSF Contrast

AA Meeting Attendance and Involvement

The number of AA meetings attended and scores on the AA Involvement Scale (AAIS, Tonigan et al. 1996) reflecting involvement in other 12-step activities (e.g., reading the *Big Book*, having a sponsor, doing steps) were collected across the followup from the Form 90 (Miller 1996). Analyses were conducted on each of these sets of variables within each arm; only those results that involve level of impairment and its interaction with treatment are reported.

AA Attendance. A repeated-measures ANOVA was conducted with therapy type and level of impairment as the independent variables and AA meeting attendance across the followup period as the repeated measure. No main effects for level of impairment, 2-way interactions of impairment by time, or 3-way interactions involving therapy condition, impairment level, and AA meeting attendance across followup points were found in any of the analyses.

Two summary variables were derived from the AA meeting attendance and involvement measures, representing the average of these variables collapsed across the 3- through 15-month followup period. These were then trichotomized based on their respective distributions to provide for high, medium, and low AA attendance and AA involvement categories. No significant relationship was found between level of impairment, type of therapy, and frequency of AA meeting attendance in the outpatient arm.

AA Involvement. Similar analyses were conducted with the AA Involvement Scale. A repeated measures ANOVA was conducted with therapy type and level of impairment as the independent variables and AA involvement scores across the followup period as the repeated measure and dependent variable. A significant effect was found for the interaction between level of impairment and AA involvement in the outpatient sample (Pillai's=0.033, F=2.438, p=.024, within-clients F=2.753, p=.012). This difference appears attributable to the differential increase in the level of AA involvement among clients in the high impairment group relative to that in the other impairment categories (figure 8). Subsequent post hoc comparisons indicate that the high impairment group, while not differing at baseline from the other conditions, had higher AA involvement scores at the 1–3- and 4–9-month periods than the other two impairment groups, which did not differ from one another.

A significant chi square was found between level of impairment and AA involvement category for the outpatient sample, collapsing across type of therapy (X^2=10.260, p=.036). This appears to be related to the relatively large number of individuals in the high impairment group who had a high level of AA involvement, particularly when compared to those in the low impairment range who were low in their AA involvement (figure 9).

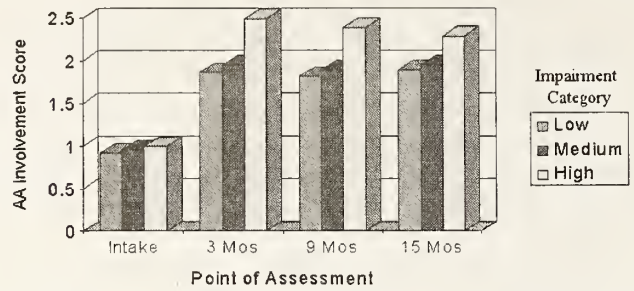

Figure 8. AA involvement score as a function of level of cognitive impairment: Outpatient sample.

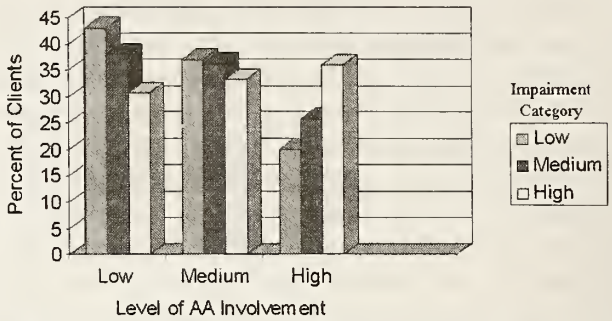

Figure 9. Relationship between level of AA involvement and level of cognitive impatient: Outpatient sample.

The relationship between AA involvement and level of impairment on drinking and abstinence during the therapy delivery period was examined. Two variables were included as indices. The first was whether abstinence or drinking occurred in a given week; the second indicated whether a heavy drinking occasion (five or more drinks on a drinking day) occurred in a given week. Repeated-measures ANOVAs were conducted for each variable, with the level of AA involvement during months 1 to 3 (trichotomized) and level of cognitive impairment as the independent variables.

In the outpatient arm, a significant interaction was found between weeks including heavy drinking across time, level of impairment, and AA involvement (F=1.422, p=.029). The interaction, depicted in figure 10, appears to be attributable to the difference between clients in the high impairment group who are either low or high on their AA involvement. Highly impaired clients who were highly involved in AA had considerably fewer weeks involving heavy drinking episodes. There was no relationship between level of AA involvement, impairment, and abstinent weeks in the outpatient arm of the trial.

Examination of the trichotomized classification of AA meeting attendance during months 1 to 3 indicated that it may be related differentially to abstinent weeks during this period for individuals differing in their level of cognitive impairment. In the outpatient arm, a significant multivariate interaction was found involving these three variables (Pillai's=0.076, F= 1.387, p=.04); the within-client interaction approached significance (F=1.318, p=.072). The interaction appears to be attributable to the relatively larger proportion of abstinent weeks for those in the high impairment category who were also in the high frequency of AA meeting attendance group during months 1 to 3, particularly in comparison to highly impaired clients who were in the lowest AA attendance category.

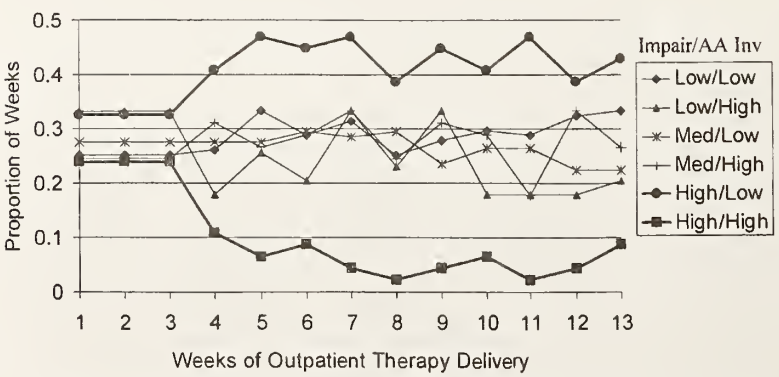

Figure 10. Proportion of weeks with a heavy drinking episode during outpatient therapy as a function of level of cognitive impairment.

Summary of Outpatient Findings

The results of analyses in the outpatient arm suggest the following:

- Cognitive impairment does not appear to be prognostic of drinking-related outcomes during the therapy delivery period, across the 1-year posttreatment followup, or at a 3-year posttreatment followup.
- There appear to be no matching effects between cognitive impairment and type of therapy at any of these time points.

- MET was found to have significantly more structure than CBT, while CBT is comparable to TSF, and TSF and MET are comparable.
- MET clients attended fewer therapy sessions than either CBT or TSF clients, while those receiving TSF attended significantly fewer sessions than did CBT clients.
- Individuals with a high degree of cognitive impairment who received CBT attended fewer therapy sessions, were more likely to be classified as low therapy attendees (≤2 sessions), and were less likely to complete therapy than those with low levels of impairment.
- Those with high levels of impairment appear to have a less positive working alliance with their therapists overall than those who are in the low impairment category.
- Those with high levels of impairment who were in CBT appear to have developed less positive interpersonal bonds with their therapists than those with low impairment; clients with high levels of impairment had significantly greater AA involvement than those with low impairment.
- Those in the high impairment group who had a high level of AA involvement had significantly fewer weeks in which heavy drinking occurred during the therapy delivery period than those who were low in AA involvement.

Results: Aftercare Arm

The analyses conducted in the aftercare arm of the study paralleled those in the outpatient arm. This section presents the results of these analyses for the aftercare arm of the trial.

Tests for Prognostic and Matching Effects

Level of cognitive impairment was not predictive of treatment outcome (no main effect for cognitive impairment) either during the treatments (months 1–3) or across the 1-year followup period (months 4–15) for aftercare clients. However, matching effects were apparent within treatment (table 3). A time by treatment by attribute effect was observed for both frequency (PDA, $p<.02$) and intensity (DDD, $p<.02$) of drinking. Examination of the weekly p values suggests that as treatment progressed, clients with greater cognitive impairment did progressively better in CBT than in MET, as hypothesized, relative to those with less cognitive impairment. However, these relative gains disappeared by the end of the active treatment phase, and no differences were found in the months 4–15 data. The within-treatment effects are depicted in figures 11 and 12.

Table 3. Cognitive Impairment, aftercare

		Within treatment						Posttreatment					
Treatment		MV × Tx		MV × Tx × T		MV × Tx × T²		MV × Tx		MV × Tx × T		MV × Tx × T²	
contrast		PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD
CBT vs. MET	*t*	.94	-.42	2.39	-2.34	-.29	.23	.57	-.25	-.06	-.25	.06	-.27
	p	.39	.67	**.02**	**.02**	.78	.82	.57	.81	.95	.80	.95	.79
CBT vs. TSF	*t*	-1.10	.27.	1.71	-2.16	.41	-.16	.38	-.24	1.18	.08	-.58	-.25
	p	.27	.79	.09	**.03**	.68	.87	.70	.81	.24	.93	.57	.80
MET vs. TSF	*t*	-1.81	.62	-.71	.27	.62	-.35	1.19	.02	1.07	.29	-.55	.03
	p	.07	.54	.48	.79	.54	.73	.85	.99	.29	.77	.59	.97
MV × Tx	*F*	1.65	.19	3.25	3.70	.19	.06	.18	.04	.83	.05	.21	.05
	p	.19	.82	**.04**	**.02**	.82	.94	.84	.96	.44	.95	.81	.95

NOTE: MV=matching variable, Cognitive Impairment; Tx=therapy condition; T=time; T^2=quadratic time; PDA=percentage of days abstinent; DDD=drinks per drinking day

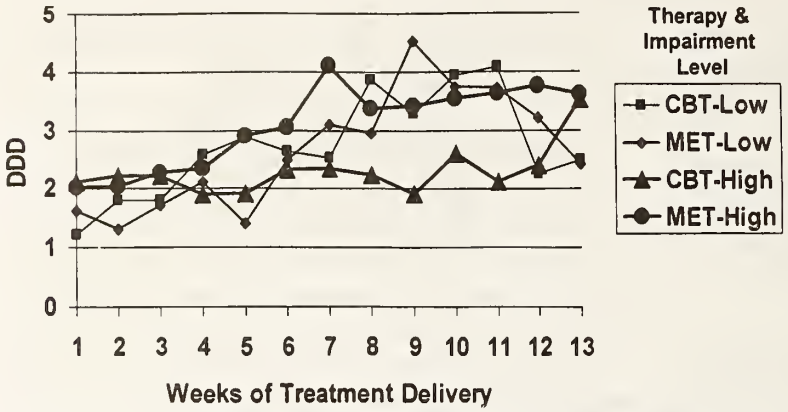

Figure 11. Drinks per drinking day (DDD) in aftercare during months 1–3 as a function of level of cognitive impairment: CBT versus MET contrast. Predicted contrasts are represented by heavy lines.

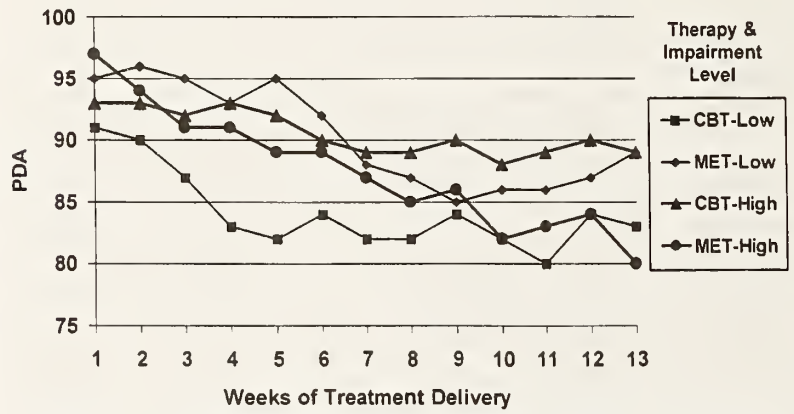

Figure 12. Percentage of days abstinent (PDA) in aftercare during months 1–3 as a function of level of cognitive impairment: CBT versus MET contrast. Predicted contrasts are represented by heavy lines.

It was also hypothesized that clients higher in cognitive impairment would have better drinking outcomes when treated in TSF than when treated in MET, relative to those with less cognitive impairment. This hypothesis was also supported through the treatment period (months 1–3) but also disappeared during the subsequent 12-month followup period.

Lastly, it was hypothesized that TSF would be more helpful than CBT for aftercare clients high in cognitive impairment. Examination of the attribute by treatment by time interaction on DDD ($p<.03$) at the weekly level suggests that highly impaired clients treated in TSF tended to drink less on drinking days during the first week or two of treatment than if treated in CBT. However, as the weeks of treatment went on, this effect disappeared.

CBT Versus MET and TSF Versus MET Contrasts

Therapy Structure

No differences were found in the level of structure in the aftercare arm as a function of level of cognitive impairment ($F=0.767$, $p=.465$), type of therapy ($F=0.289$, $p=.749$), or the interaction between these two variables ($F=0.822$, $p=.512$). Thus, as in the outpatient arm, a major component of the putative causal chain, that CBT and TSF would be rated as having greater structure than MET, was not supported.

Therapy Attendance and Treatment Dose

Sessions Attended. A significant effect for type of therapy was found with respect to the number of therapy sessions attended (CBT, 8.12; MET, 3.15; TSF, 7.36) ($F=125.31$, $p=.000$). However, there were no significant differences in therapy attendance as a function of level of cognitive impairment or its interaction with type of treatment.

Percentage of Sessions Attended. Differences were found in the percentage of sessions attended across the CBT (67.6 percent), MET (78.8 percent), and TSF (61.4 percent) groups. No significant differences were found as a function of level of cognitive impairment ($F=2.360$, $p=.095$); however, a trend was found for highly impaired clients (65 percent) having lower attendance than those in medium or low impairment groups (71 percent for each). No interaction was found between level of impairment and type of aftercare therapy ($F=0.273$, $p=.896$).

Categorical Attendance Indices. Nearly a quarter (24.2 percent) of the aftercare clients were classified as low therapy attendees (≤2 sessions); 47.8 percent of the aftercare clients (63.2 percent of those attending 3 or more sessions)

were classified as therapy completers. A significant relationship was found between cognitive impairment and aftercare therapy attendance (0–2 sessions versus 3 or more sessions) (X^2= 6.123, p=.047); 28.4 percent of clients in the high impairment category were low therapy attendees compared to 19.6 percent and 22.1 percent for the low and medium impairment groups, respectively. However, there was no relationship between level of impairment and therapy completion status in the aftercare arm. When the type of therapy was factored into multilevel chi-square analyses, no differences were found on either of these two measures as a function of type of therapy or within a given therapy as a function of level of impairment.

Working Alliance. There were no differences as a function of type of therapy, level of impairment, or their interaction in the aftercare arm on the total WAI score or on any of the three WAI subscales rated by either therapists or clients.

CBT Versus TSF Contrast

AA Meeting Attendance and Involvement.

AA Attendance. A repeated-measures ANOVA was conducted with therapy type and level of impairment as the independent variables and AA meeting attendance across the followup period as the repeated measure. No main effects for level of impairment, 2-way interactions of impairment by time, or 3-way interactions involving therapy condition, impairment level, and AA meeting attendance across followup points were found in any of the analyses.

AA Involvement. No relationship was found among AA involvement, measured as either a continuous variable in repeated-measures analyses or as a categorization based on the average level of involvement, level of impairment in chi-square analyses, and type of treatment in the aftercare arm.

The relationship between AA involvement during the therapy delivery period and level of impairment on drinking and abstinence during that same period was examined using the number of abstinent weeks and the number of weeks including a heavy drinking occasion as the dependent variables. Repeated-measures ANOVAs were conducted for each variable, with the level of AA involvement during months 1 to 3 (trichotomized) and level of cognitive impairment as the independent variables. There were no differences across time in either the number of abstinent weeks or weeks including heavy drinking as a function of the level of AA involvement, cognitive impairment, or their interaction among aftercare clients. Similarly, the trichotomized classification of AA meeting attendance was not related to the number of abstinent weeks or weeks including heavy drinking among aftercare clients.

Summary of Aftercare Findings

The results of analyses in the aftercare arm suggest the following:

- Cognitive impairment does not appear to be prognostic of drinking-related outcomes during the therapy delivery period or across the 1-year posttreatment followup.
- There appeared to be some support for a matching effect between level of cognitive impairment and type of therapy during months 1–3 while treatment was being delivered, with clients higher in cognitive impairment having somewhat better within-treatment drinking outcomes when treated in either CBT or TSF compared to MET, and those in TSF doing somewhat better early in treatment compared to those in CBT.
- These apparent matching effects dissipated over time and had disappeared by the end of the active treatment phase.
- There were no differences across the three aftercare therapies with respect to their levels of therapeutic structure.
- No differences or interactions with type of treatment were found for level of cognitive impairment and the number of therapy sessions attended, the percentage of sessions attended, or therapy completion rates; however, those with high levels of impairment were more likely to be classified as low therapy attendees than those with low levels of impairment.

- There appeared to be no relationship between level of impairment and the level of therapeutic alliance as viewed from either the clients' or therapists' perspectives.
- No relationships were found between the level of cognitive impairment and AA attendance or level of AA involvement.

Discussion

Treatment Outcome

The present findings raise questions concerning the utility of measures of cognitive impairment in matching clients to the three treatments used in Project MATCH. In the outpatient setting, the cognitive impairment index was found to have neither a prognostic main effect nor an interaction with treatments on percentage of days abstinent or drinks per drinking day during the 3 months of active therapy, across the 12-month followup period, or at a followup approximately 3 years after treatment. While there was some suggestive evidence of matching in the aftercare setting during the active treatment phase (months 1–3), these effects occurred in only a brief window of time, dissipated rapidly, and were not observed in months 4–15. Thus, the results fail to support the hypothesized main effects, which predicted that more cognitively impaired clients would have poorer outcomes. This portion of the results are consistent with others that have raised questions about the clinical utility of measures of cognitive function in predicting treatment outcomes among alcoholics (Donovan et al. 1984). The results also fail to support the hypothesized interactions that would have indicated a matching effect between level of impairment and type of therapy.

Causal Chain Analyses and Process Measures

Outpatient Arm

Given the lack of prognostic main effects or matching interaction effects between cognitive impairment and type of therapy, the aim of the causal chain analysis for the outpatient arm of the trial was to determine where the causal chain broke down. The first causal chain, involving the contrasts between MET and CBT and TSF, seems to have failed in part because MET appeared to have higher levels of therapeutic structure (as rated after Session 2) than either CBT or TSF. This finding is contrary to the hypothesis that CBT and TSF would be more structured. Further, outpatients high in cognitive impairment did not differ from those low in impairment on the degree of structure observed in their therapy sessions nor was there an interaction between level of impairment and therapy with respect to observed structure.

The second causal chain was partially supported in that cognitive impairment was related in the expected direction with therapy dose. High impairment was associated with fewer sessions attended, suggesting that those who were more impaired found therapy less helpful than those who were less impaired. More importantly, cognitive impairment interacted with the type of therapy to influence attendance. Clients with high levels of impairment who received CBT attended fewer sessions than those having low levels of impairment or than their counterparts in the other therapy conditions.

This differential therapeutic dose was also supported by the percentage of sessions attended, classification as low or high therapy attendees, and categorization as therapy completers. Thus, there appears to be cumulative evidence that level of impairment interacts with CBT to reduce various indices of treatment dose. However, it is not clear whether these differences in attendance as a function of type of therapy and impairment level are related to longer term drinking-related outcomes. This relationship should be tested in future analyses.

In a search for process factors that might be a function of the interaction between type of therapy and cognitive impairment, working alliance, AA attendance, and AA involvement were explored. A number of interesting indirect lines of evidence emerged from these analyses, when combined with the results concerning therapy dose, to support the possibility that CBT-oriented outpatient programs may be less acceptable to individuals who are more cognitively impaired. First, high impairment clients in CBT had a lower level of overall working alliance and

a less positive interpersonal bond with their therapists than did clients in the low impairment category.

Second, more highly impaired outpatients treated in CBT, but not those in TSF or MET, were classified as low therapy attendees and were less likely to complete therapy. Thus, it appears that outpatients who were more impaired were more likely to be premature dropouts who thereby received a smaller dose of the active ingredients of the CBT therapy.

Third, more impaired outpatients tended to have higher levels of AA involvement than less impaired clients. Finally, interactions were found suggesting that higher levels of AA involvement during the period when the therapies were being delivered were associated with fewer weeks in which heavy drinking episodes occurred among highly impaired clients relative to less impaired ones. Similarly, higher frequency of AA meeting attendance during months 1 to 3 was associated with more weeks of abstinence among more highly impaired clients than among less impaired ones.

Aftercare Arm

Given the findings suggesting interaction effects between cognitive impairment and type of therapy during the active phase of treatment, although these interactions dissipated over the 3 months and were not observed over the 1-year followup period, the testing of the causal chain had two main goals: (1) to test whether any of the causal chain elements were supportive of these initial matching effects and (2) to identify where and when the causal chain broke down.

The first causal chain (MET versus TSF or CBT) failed to be supported in that the level of observed structure was comparable across therapies, although it was hypothesized that MET would have less structure than the other two therapies. The second causal chain (TSF versus CBT) was not supported either. Session attendance was unrelated to the cognitive impairment by therapy interaction. This was the case whether attendance was measured by the number or percentage of sessions attended.

Nor was session attendance affected by the level of impairment. While use of therapy completion as a criterion supported the expectation that more highly impaired aftercare clients would be less likely to complete therapy than those low in impairment, neither this measure nor the classification as low versus high therapy attendance supported the hypothesized interaction between impairment level and type of therapy. Thus, there was no support overall for the causal chain indicating that therapy dose interacted with level of impairment. The absence of this causal chain might underlie the lack of the hypothesized matching effect.

Again, as in the outpatient arm, working alliance, AA attendance, and AA involvement were explored as process factors that might vary as a function of the interaction between type of therapy and cognitive impairment. However, unlike the outpatient results, the results of analyses with these variables were less informative. Neither the therapist nor the client Working Alliance Inventory total or subscale scores were found to be affected by level of impairment, type of therapy, or their interaction.

Similarly, neither AA meeting attendance nor AA involvement was influenced by level of impairment, type of therapy, or their interaction. When AA involvement was included as a factor in predicting heavy drinking weeks and weeks of abstinence during the active treatment phase, it was found that these drinking-related measures were not affected by the combination of AA involvement and level of impairment.

Implications

A number of issues are raised by the present findings and their failure to support cognitive impairment as either a prognostic or matching variable. First, if one looks carefully at the recommendations in the literature for more structured approaches (such as CBT) with impaired alcoholics (e.g., Donovan et al. 1987; McCrady 1987), there is a strong emphasis on the use of repeated exposure to the same material, behavioral rehearsal, and demonstrated mastery of the targeted skills. Such an approach, if implemented in the manner recommended, may well be the most appropriate strategy for cognitively impaired clients.

However, in examining the implementation of the CBT protocol in Project MATCH, it may have been too fast paced and too cognitively focused, with much less emphasis on the more concrete and repetitive behavioral rehearsal strategies thought to be appropriate for this subgroup. It may be that rather than skills *training*, the CBT protocol provided skills *exposure*. That is, given that only one session focused on a given topic area, clients may have been exposed to the general concepts of CBT but had insufficient time to consolidate these concepts and rehearse them to the point of demonstrated mastery. As such, the more impaired clients may not have gained sufficient behavioral training to accommodate their deficits. However, no tests of behavioral skills acquisition or generalization were included in the trial.

Second, while cognitive impairment was found to be related to a number of process measures, it may be that its role in predicting drinking-related treatment outcome has been overrated. While the level of impairment has been found to predict treatment outcome among alcoholics, the results have been equivocal and, where relationships have been found, the amount of variance accounted for by cognitive function has often been relatively small (Donovan et al. 1984; Eckardt et al. 1988; Wilkinson and Sanchez-Craig 1981). Cognitive function has been found to be most consistently related to outcome in those studies in which extreme groups (e.g., unimpaired versus markedly impaired) have been compared (Donovan et al. 1984; Knight and Longmore 1994). The sample recruited into Project MATCH, while demonstrating considerable range in cognitive function, did not include clients with the marked level of impairment that is often associated with poor drinking-related treatment outcomes.

A number of researchers (e.g., Donovan et al. 1984; Eckardt et al. 1988; Goldman 1995) have suggested that while important in the prediction of outcome, cognitive impairment is only one of a number of variables that contribute to the determination of treatment outcome. Knight and Longmore (1994) have noted that while most research in this area presumes a causal role for cognitive impairment in poor treatment outcomes, such deficits may simply be correlates of other factors, such as age, chronicity, severity of dependence, or low social stability, that actually determine the response to treatment.

Also, the posttreatment environment may or may not pose a challenge for the individual's cognitive abilities (Goldman 1995). The effects of cognitive impairment are most likely to be observed in novel situations or those that pose a challenge to individuals and their cognitive problem-solving abilities. Also, performance on cognitive measures of problem-solving are not necessarily reflective of the individual's interpersonal problem-solving abilities (Nixon et al. 1992), which may be more important in dealing with posttreatment relapse precipitants.

Glass (1991) has suggested that alcohol-related impairment can affect mood, judgment, and self-esteem, which influence the motivation one needs in order to achieve and maintain abstinence. She argued that neuropsychological function should be viewed as part of the total and more complex picture in which variables such as motivation to change, social stability, personality, and comorbid psychological problems may also influence treatment process and outcome. This view is consistent with the results of Donovan and associates (1986), who found that clinically meaningful client subtypes, defined by level of cognitive impairment, psychopathology, alcohol dependence, and demographic characteristics, provided a better predictor of outcome than did cognitive impairment alone.

A third issue deals with the assessment of cognitive function. In order to minimize client burden from an already lengthy assessment process in Project MATCH (see Connors et al. 1994), only a few measures were used to assess cognitive function. It may be that other tests assessing different areas of function or assessing in greater depth would have been more sensitive to deficits and possibly would have provided more positive results with respect to outcome or treatment matching. Similarly, a number of alternative strategies for combining the measures of cognitive impairment, rather than a factor-analytically derived continuous index of impairment, might be more effective as predictors of

outcome. As an example, Kadden and colleagues (1989) assigned scores of 0 or 1 (unimpaired/impaired) for each of three cognitive tests administered to aftercare clients; individuals were classified as impaired if they scored in the impaired range on two out of the three tests.

The choice of measures raises two related issues. The first is that currently available measures of cognitive function may be inadequate in their ability to assess or predict those skills and abilities involved in the treatment process and those needed to deal with the posttreatment environment. Knight and Longmore (1994) indicated that it is difficult to determine which tests best assess the cognitive skills needed to consolidate and apply treatment-related skills.

The use of "ecologically valid" measures has been raised previously (e.g., Sussman et al. 1986). However, most available measures of cognitive function are lacking in this ecological validity. The use of measures of treatment-relevant information (e.g., Becker and Jaffe 1984; Godding et al. 1992; Roehrich and Goldman 1993) and the acquisition, retention, and application of specific skills such as cognitive-behavioral problem-solving or drink refusal (e.g., Nixon et al. 1992; Sanchez-Craig et al. 1987; Smith and McCrady 1991) seem like important directions to pursue (Knight and Longmore 1994).

A related issue involves determining the best measures of treatment outcome to investigate in relation to cognitive function. Donovan and associates (1984) found that measures of neuropsychological function were better in predicting posttreatment employment status than drinking-related outcomes. Outcomes such as employment may be much more directly related to the skills and abilities assessed by most measures of cognitive function than is drinking behavior. Although there is the hope of finding a causal link between cognitive impairment and relapse, no such link has yet been demonstrated convincingly (Knight and Longmore 1994).

Conclusions

The present results fail to support level of cognitive impairment, as assessed, as either a prognostic indicator of treatment outcome or as a variable useful in matching clients to one of the three treatments presented in Project MATCH. A number of factors may have contributed to these findings, which failed to support the a priori hypotheses. It may be best to view cognitive function as one variable class that contributes to, but does not independently predict treatment outcome. As Knight and Longmore (1994) suggested, the significance of cognitive impairment must be placed in a wider context that integrates findings concerning cognitive function with other psychosocial and treatment variables. Specifying these interactions with greater precision may provide useful clinical information to alcohol counselors and therapists.

Acknowledgments

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Matching Clients to Alcoholism Treatment Based on Psychopathology

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ABSTRACT

The psychopathology-related findings from Project MATCH included examination of an a priori matching hypothesis based on the Addiction Severity Index Psychiatric Composite score and a DSM–III–R diagnostic assessment. Hypothetical causal chain processes were also examined to gain a better understanding of why matching effects were or were not observed. Significant psychopathology matching interactions were found, but they were not consistent across time or outcome measures. The causal chain analyses did not reveal a mechanism of action for the matching interactions, further reducing confidence in the validity of the matching effects. With these limitations in mind, the following results provide a tentative basis for matching clients to treatment. Individuals without psychopathology had better outcomes after treatment when assigned to Twelve Step Facilitation (TSF) rather than Cognitive-Behavioral Coping Skills Therapy (CBT). Individuals with psychopathology did equally well after treatment when assigned to TSF or CBT, but had worse outcomes during treatment when assigned to Motivational Enhancement Therapy. None of the Project MATCH therapies provided treatment with an extensive focus on reducing psychiatric symptoms, so results cannot be generalized to such forms of therapy.

An extensive epidemiological study indicated that more than half of those seeking treatment for an alcohol use disorder in mental health or substance abuse settings have a comorbid nonsubstance use psychiatric disorder (Regier et al. 1990). These comorbid disorders have been shown to adversely affect substance abuse treatment outcome. Some prognostic studies have employed a categorical, diagnostic approach to measuring psychopathology. For example, Rounsaville and associates (1987), using the National Institute of Mental Health (NIMH) Diagnostic Interview Schedule, found that comorbid DSM–III diagnoses generally predicted poorer outcomes among alcoholics.

Other studies have measured psychopathology using a dimensional, continuous approach such as the Addiction Severity Index Psychiatric (ASI Psych) subscale (McLellan et al. 1992). This subscale has been found to be a significant predictor of substance abuse treatment outcome using the interviewer severity rating (McLellan et al. 1983, 1984) and the composite score (Kadden et al. 1989). Such findings are important because they suggest that substance abusers with psychopathology may require specialized treatment services.

Substance abuse outcome studies have also found significant interactions between ASI Psych scores and type of treatment. Woody and colleagues (1984) compared methadone-maintained opiate addicts assigned to paraprofessional counseling or to professional psychotherapy (cognitive-behavioral or supportive-

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expressive psychotherapy). Clients with low ASI Psych ratings did equally well with either treatment approach. However, clients with mid to high psychiatric severity had better outcomes with professional psychotherapy.

Kadden and Cooney (Kadden et al. 1989; Cooney et al. 1991) compared two approaches to group therapy for alcoholics. Alcoholics without psychopathology had better outcomes with interactional group therapy, while those with psychopathology had better outcomes with cognitive-behavioral group therapy. In addition to these 2-way interaction results, studies by McLellan and his colleagues found higher order interactions involving ASI Psych interviewer ratings and type of substance abuse treatment (McLellan et al. 1983). Clients with low ASI Psych severity did well in all programs studied, and those with high severity did poorly in all programs. The responses of those with intermediate severity scores to different types of programs depended on the degree of associated problems in social functioning.

This chapter describes in detail the psychopathology-related findings from Project MATCH (Project MATCH Research Group 1993). This included examination of an a priori matching hypothesis based on the ASI Psych composite score and a diagnostic assessment. Hypothetical causal chain processes were examined to gain a better understanding of why matching effects were or were not observed.

The Psychopathology Matching Hypothesis

Drinking outcome will be a function of an interaction between psychopathology and treatment type, such that the slope of the regression line of psychopathology on drinking outcome will be more positive for the Motivational Enhancement Therapy (MET; Miller et al. 1992) and Twelve Step Facilitation (TSF; Nowinski et al. 1992) conditions than for the Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992) condition. This interaction is illustrated in figure 1. This hypothesis was tested as two contrasts, one comparing CBT versus MET (excluding TSF) and the other comparing CBT versus TSF (excluding MET).

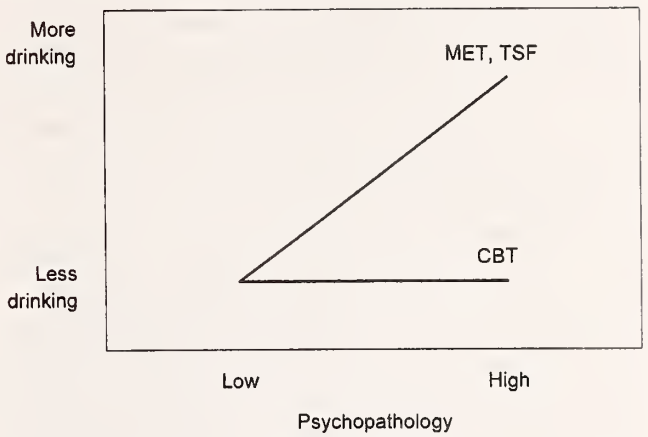

Figure 1. Hypothesized relationships between severity of dependence and drinking outcome for clients treated with TSF, CBT, and MET.

These a priori contrasts specified anticipated directional interaction effects, but they did not specify where on the psychopathology dimension to expect significant differences between treatments. Our theory, however, led us to expect that individuals with high psychopathology would have better outcomes with CBT than with MET or TSF. There was no theoretical reason to expect differences in outcome among CBT, MET, and TSF for individuals with low psychopathology.

Rationale for the Matching Hypothesis

Empirical Evidence

Prior to Project MATCH, there had been no direct test of the specific hypothesis proposed here, although two substance abuse outcome studies found significant 2-way interactions between ASI Psych scores and type of treatment (Cooney et al. 1991; Kadden et al. 1989; Woody et al. 1984). Both studies found that CBT was more effective than alternative treatments for high psychopathology clients, while CBT and alternative treatments were not significantly different for low psychopathology clients.

Severity of psychopathology has also been found in several studies to be a main effect predictor of substance abuse treatment outcome (McLellan 1986). However, data from a study by Rounsaville and associates (1987) suggested

that the relationship between psychopathology and alcohol treatment outcome might be moderated by sex. For men, having an additional diagnosis of major depression, antisocial personality, or drug abuse was associated with poorer outcome. For women, having depression was associated with a better outcome on some measures, while antisocial personality and drug abuse were associated with poorer outcome.

The finding of a differential treatment response for depressed men and women was not consistent. Rounsaville and colleagues reported significant gender by diagnosis interactions for only 4 correlated outcomes, all having to do with impairment due to drinking, out of 13 outcomes tested. Future reports based on Project MATCH data may shed some light on the question of gender by psychopathology interaction effects on treatment outcome.

Theoretical Justification

Negative moods have been shown to elicit alcohol craving (Cooney et al. 1997), and most alcohol relapse situations involve negative moods (Marlatt 1996). It is reasonable to assume that treatments that reduce the frequency or intensity of negative moods will result in reduced drinking among individuals prone to experiencing these moods, that is, individuals with anxiety or affective disorders. TSF and MET were developed uniquely for the treatment of alcoholism, whereas CBT is a more general approach that had been developed for the treatment of anxiety and affective disorders and was subsequently adapted for use with alcoholics.

General strategies used to address psychopathology were incorporated into the Project MATCH version of CBT. The elective sessions include Starting Conversations, Nonverbal Communication, and Assertiveness to help clients cope with *social anxiety*; Receiving Criticism, Awareness of Anger, and Anger Management to help clients cope with *anger*; and Awareness of Negative Thinking, Managing Negative Thinking, Increasing Pleasant Activities, and Managing Negative Moods and Depression to help clients cope with *depression*. On the other hand, TSF and MET offer no direct interventions for clients with psychopathology. MET's brevity precludes anything but a focus on drinking and is client-structured, which may be too demanding for those with significant psychopathology. The TSF therapist makes the assumption that most psychopathology is a result of the disease process. Mild psychopathology is thought to improve with abstinence, and severe psychopathology is thought to require referral to a mental health professional for adequate treatment.

More intensive treatment is often recommended for alcoholics with high psychopathology, so we predicted a difference in outcome between CBT and MET in high psychopathology clients. Based on this prediction, we tested one a priori contrast dropping the TSF client group and examining the interaction between psychopathology and CBT/MET treatments. The interaction between psychopathology and CBT/TSF treatment was examined as the second a priori contrast. This second contrast tested treatments equated on intensity of treatment, allowing an interpretation of matching effects related to the content of treatment.

Operationalization of the Matching Variable

Psychopathology can be operationalized using either a global, continuous measure or a categorical variable based on a diagnostic assessment. Project MATCH utilized both measurement approaches, and a priori matching hypotheses were developed using the ASI Psych and the Computerized Diagnostic Interview Schedule (C–DIS). The ASI Psych measure consists of 11 items covering the occurrence of psychological problems (e.g., depression, anxiety, and anger) in the past 30 days. The C-DIS is a computer-administered interview based on the Diagnostic Interview Schedule (Blouin et al. 1988; C–DIS Management Group 1991) which can yield psychiatric disorder identification based on the DSM–III–R.

Only the anxiety disorders, affective disorders, and antisocial personality disorders sections on the C–DIS were administered. Participants were considered to meet criteria for a current comorbid Axis I disorder if they met DSM–

III–R criteria for any lifetime anxiety or affective disorder and reported one or more relevant symptoms in the past 6 months. This definition of current diagnosis does not exactly correspond with the DSM–III–R definition of current diagnosis because the C–DIS does not provide sufficient probes to determine whether an individual has enough current symptoms to satisfy criteria for current diagnosis. Thus, the C–DIS may at times classify individuals as having a current disorder when they are actually in partial remission.

The ASI Psych score and the C–DIS diagnostic variable were only moderately correlated (aftercare sample point-biserial r=0.43, outpatient sample point-biserial r=0.27), so they were examined in separate matching analyses. The ASI Psych measure was selected as a primary matching variable, while the C–DIS was selected as a secondary matching variable. The Steering committee selected ASI Psych as the primary matching variable because it had yielded significant attribute by treatment interactions in three previous substance abuse psychotherapy outcome studies (Kadden et al. 1989; McLellan et al. 1983; Woody et al. 1984).

To our knowledge, no substance abuse outcome study has reported a significant attribute by treatment interaction using an Axis I psychiatric diagnosis-based client variable. There was no a priori basis for determining the point on the psychopathology symptom continuum where CBT would be more effective than TSF or MET. It was hypothesized that the greater overall psychopathology present, the more incrementally effective CBT will be, relative to either TSF or MET.

Sample Characteristics

The Project MATCH sample had a mean pretreatment ASI Psych composite score in the outpatient arm of 0.19 (*SD*=0.19) with 38 percent of participants having a zero score. The aftercare arm had a mean score of 0.23 (*SD*=0.21) with 35 percent having a zero score. These scores are slightly lower than normative data from alcohol abusers (mean=0.24) reported by McLellan and associates (1992). Table 1 shows the percentage of participants meeting our operational definition of current comorbid affective and/or anxiety disorders based on the pretreatment C–DIS assessment. Among participants with anxiety disorders, there was an approximately even distribution of participants meeting criteria for social phobia, simple phobia, agoraphobia, generalized anxiety disorder, and panic disorder. Among those with affective disorders, most participants met criteria for major depressive disorder, with few meeting criteria for bipolar disorder or manic episode.

Table 1. Percentage of participants meeting criteria for current comorbid DSM–III–R diagnoses

	Aftercare arm (N = 748)	Outpatient arm (N = 870)
No current comorbid diagnosis	56.0	67.9
Current comorbid anxiety diagnosis	35.7	25.7
Current comorbid affective diagnosis	20.5	13.8
Current anxiety or affective diagnosis	44.0	32.1

NOTE: Current DSM–III–R diagnoses are defined in the text and may include some cases in partial remission.

Results

Prognostic Effects

The prognostic effects of pretreatment ASI Psych and pretreatment current comorbid Axis I diagnosis on posttreatment alcohol consumption were examined in outpatient and aftercare samples aggregated across all three treatments. Prognostic analyses were conducted using a "latent growth" approach that was utilized in the previously reported analysis of matching effects (Project MATCH Research Group 1997; Longabaugh and Wirtz, this volume, pp. 4–17). The prognostic model included a backward elimination adjustment for the other significant a priori matching attributes and their matching interaction effects.

There were no prognostic main effects of ASI Psych or comorbid Axis I diagnosis on percentage of days abstinent (PDA) or drinks per drinking day (DDD) across the 1-year posttreatment period in either the aftercare or outpatient arm of the study. ASI Psych did interact with time to predict PDA and DDD outcomes (p's<.05) in the aftercare arm. Toward the end of the followup period, clients higher in psychiatric severity had fewer abstinent days compared to those lower in psychiatric severity. However, these time-limited prognostic effects accounted for less than 2 percent in outcome variance.

Interaction Effects

Psychopathology by treatment interaction effects were also modeled as a latent growth process. Tables 2 and 3 show F and nondirectional p values for all possible psychopathology interaction effects using the ASI Psych and C–DIS matching variables. The p values in these tables should be halved to determine the directional p values.

Each matching hypothesis in Project MATCH was tested separately at a family-wise type-1 error rate of 5 percent. A Bonferroni correction was applied to take into account the two outcome variables and the two contrasts proposed for the psychopathology hypothesis, resulting in a corrected alpha level of 0.0125. This strategy does not take into account the number of different hypotheses that were tested, since the matching hypotheses were conceived of as conceptually independent of one another.

The only interaction effect that reached a Bonferroni-corrected level of significance was

Table 2. Interaction effects based on Addiction Severity Index Psychiatric Composite score

Treatment		Within treatment						Posttreatment					
		MV × Tx		MV × Tx × T		MV × Tx × T^2		MV × Tx		MV × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD
Outpatient arm													
CBT vs. MET	F	3.20	1.04	1.10	1.06	0.03	1.54	0.96	0.06	0.18	0.52	0.00	0.72
	p	.07	.31	.29	.30	.86	.21	.33	.81	.67	.47	.95	.39
CBT vs. TSF	F	2.43	0.04	2.86	3.92	1.46	0.27	4.88	3.03	2.28	0.42	4.75	2.96
	p	.12	.84	.09	**.05**	.23	.60	**.03**	.08	.13	.51	**.03**	.08
MET vs. TSF	F	0.08	0.66	0.34	0.76	1.77	2.96	1.28	1.96	3.39	1.72	4.49	0.62
	p	.78	.42	.56	.38	.18	.09	.26	.16	.07	.19	**.03**	.43
Overall	F	1.94	0.56	1.47	1.97	1.09	1.55	2.45	1.70	1.92	0.86	3.09	1.49
	p	.14	.57	.23	.14	.34	.21	.09	.18	.15	.42	**.05**	.23
Aftercare arm													
CBT vs. MET	F	0.05	0.52	0.50	1.12	1.66	0.01	0.62	0.09	2.25	0.74	0.17	0.59
	p	.82	.47	.48	.29	.20	.92	.43	.76	.13	.39	.68	.44
CBT vs. TSF	F	0.01	0.03	1.74	1.39	1.02	0.26	0.21	0.46	0.25	2.37	0.14	1.77
	p	.90	.86	.19	.24	.31	.61	.64	.50	.62	.12	.70	.18
MET vs. TSF	F	0.12	0.31	0.13	0.01	0.08	0.17	1.59	0.98	1.04	0.44	0.62	0.30
	p	.72	.58	.55	.92	.77	.68	.21	.32	.31	.51	.43	.58
Overall	F	0.06	0.29	0.87	0.84	0.92	0.15	0.81	0.51	1.18	1.19	0.32	0.90
	p	.94	.75	.42	.43	.40	.86	.45	.60	.31	.30	.73	.41

NOTE: MV = matching variable, Addiction Severity Index Psychiatric Composite score, Tx = treatment, T = time, T^2 = quadratic time. All p values are nondirectional and should be halved to determine p values for a directional hypothesis test.

Table 3. Interaction effects based on current DSM–III–R diagnosis from the Computerized Diagnostic Interview Schedule

Treatment		Within treatment						Posttreatment					
		MV × Tx		MV × Tx × T		MV × Tx × T^2		MV × Tx		MV × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD
Outpatient arm													
CBT vs. MET	*F*	3.88	3.50	2.59	1.49	0.48	2.34	0.23	1.25	0.00	0.16	0.66	0.07
	p	.05	.06	.11	.19	.49	.13	.63	.26	.97	.69	.42	.80
CBT vs. TSF	*F*	0.28	2.02	0.42	0.03	0.81	1.37	1.49	2.72	0.00	0.12	3.61	2.37
	p	.60	.16	.52	.86	.37	.24	.22	.10	.99	.73	.06	.12
MET vs. TSF	*F*	2.23	0.26	5.43	2.40	0.04	0.49	0.50	0.23	0.00	0.56	2.89	1.56
	p	.13	.61	**.02**	.12	.84	.69	.48	.63	.98	.45	**.01**	.21
Overall	*F*	4.45	3.57	8.00	1.93	0.19	1.61	0.57	2.00	0.00	0.07	4.57	1.88
	p	.12	.15	.06	.25	.65	.28	.47	.24	1.00	.75	**.03**	.25
Aftercare arm													
CBT vs. MET	*F*	3.76	2.02	0.02	1.12	0.52	0.05	0.86	0.40	1.12	0.21	0.27	0.62
	p	.05	.15	.90	.29	.47	.83	.35	.53	.29	.59	.60	.43
CBT vs. TSF	*F*	1.02	0.88	0.00	0.01	0.37	1.18	0.00	0.00	0.35	0.61	0.01	0.01
	p	.31	.35	.97	.91	.54	.27	.99	.95	.56	.44	.90	.92
MET vs. TSF	*F*	0.86	0.23	0.03	1.37	1.77	0.31	0.94	0.02	0.94	0.02	0.48	0.46
	p	.35	.63	.88	.24	.18	.19	.36	.58	.64	.19	.52	.49
Overall	*F*	3.53	1.10	0.00	0.70	0.77	0.96	0.31	0.06	0.32	0.76	0.05	0.14
	p	.15	.35	.99	.43	.41	.38	.57	.79	.57	.42	.79	.69

NOTE: MV = matching variable, Computerized Diagnostic Interview Schedule Axis I, Tx = treatment, T = time, T^2 = quadratic time. All *p* values are nondirectional and should be halved to determine *p* values for a directional hypothesis test.

the psychiatric severity by treatment (CBT versus TSF) effect in the outpatient arm in the posttreatment period with PDA outcome (directional p=.01). The psychiatric severity by treatment by quadratic time effect was also significant for this contrast (p=.03). Figure 2 illustrates this interaction effect in each of the 12 posttreatment months.

Post hoc examination of this contrast by month indicated that there were significant (p< .05) psychiatric severity by treatment interaction effects beginning 1 month after treatment termination and continuing through the eighth month after the end of treatment. Interaction plots revealed that individuals without psychopathology reported approximately 87 percent of days abstinent in TSF treatment compared with 73 percent of days abstinent reported by those in CBT. The CBT and TSF regression lines crossed at a value of approximately 0.4 on the ASI Psych composite score, more than one standard deviation above the outpatient sample mean. With few clients having ASI Psych scores above this intersection point, it was not possible to determine whether there was a significant advantage for high psychopathology clients treated with CBT rather than TSF.

Several interaction effects in the outpatient arm approached the Bonferroni-corrected level of significance. The psychiatric severity by treatment (CBT versus TSF) contrast approached significance for the DDD outcome in the posttreatment period (directional p=.04) and for the PDA outcome in the within-

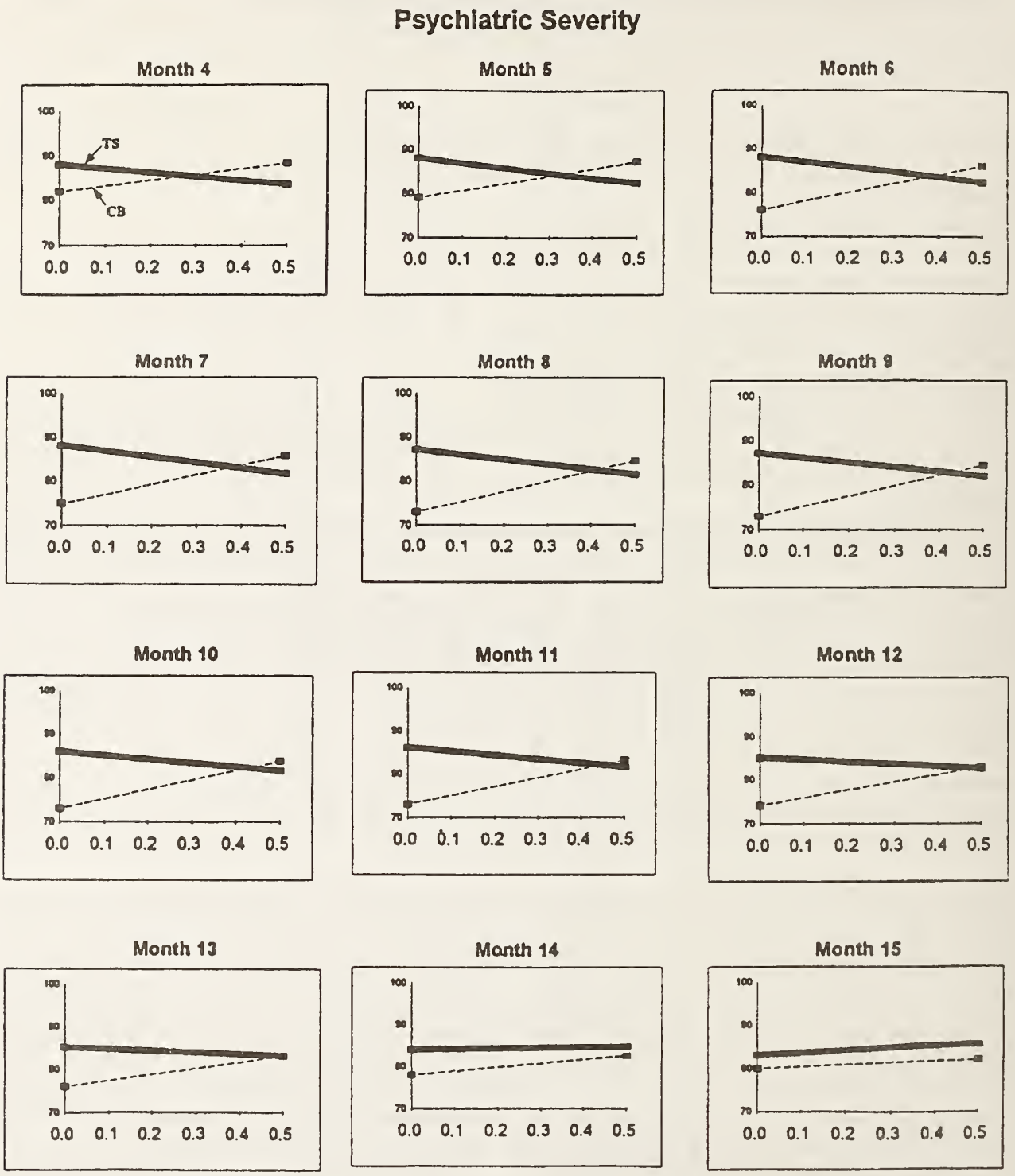

Figure 2. Posttreatment plot of percentage of days abstinent in the outpatient arm showing the interaction between CBT and TSF treatments and baseline ASI Psych severity. The vertical axes are predicted outcome scores and the horizontal axes represent baseline ASI Psych composite scores, with higher scores indicating higher psychopathology. (Reprinted with permission from *Journal of Studies on Alcohol*, Vol. 58, pp. 7–29, 1997. Copyright by Alcohol Research Documentation Inc., Rutgers Center of Alcohol studies, Piscataway, NJ 08854.)

treatment time period (directional p=.06). Also in the outpatient arm, the C–DIS comorbid diagnosis by treatment (CBT versus TSF) interaction approached the Bonferroni-corrected level of significance for the DDD outcome in the posttreatment period (directional p<.05).

Among the CBT versus MET contrasts and the TSF versus MET contrasts, none met Bonferroni-corrected significance levels, and only one (CBT versus MET, within-treatment PDA outcome) approached significance (directional p=.04). Note that no a priori TSF versus MET matching hypotheses were specified in advance. Outcomes for clients without psychopathology assigned to MET were intermediate between the outcomes for clients assigned to CBT and TSF.

Time to Event Outcomes

The primary outcome analyses in Project MATCH were conducted using the latent growth approach described above, with PDA and DDD outcome variables. It was of secondary interest, however, to determine the impact of treatment matching on time to relapse. Survival analysis techniques were used to investigate the time to first incidence of heavy drinking, where heavy drinking was defined differentially according to gender. Heavy drinking was indexed for males as six or more standard drinks in a single day and for females as four or more standard drinks in a day.

Time to event data were analyzed separately for each study arm (aftercare or outpatient), time window (within treatment or posttreatment), and psychopathology indicator (ASI or C–DIS). A nonproportional Cox regression model was used to test for differences in survival rates. The model was nonproportional because it included time itself as a covariate and thus allowed the hazard ratio to vary as a function of time (Cox and Oakes 1984). The model included main effects for site, treatment group, and psychopathology indicator. It also included treatment group by psychopathology indicator, site by treatment group, site by psychopathology indicator, site by treatment group by psychopathology indicator, time by treatment group, time by psychopathology indicator, and time by treatment group by psychopathology indicator interactions. All categorical variables were coded using an effect encoding technique (Kirk 1982), and in the case of the ASI (i.e., the single quantitative measure), original scores were re-expressed as deviations from the grand mean to reduce multicolinearity. Additionally, the time variable was transformed to increase simultaneously the numerical accuracy and interpretability of the solution. The specific transformation used was $T=ln(t)-ln(m)$, where t was the original time point and m was the midpoint of the time window under consideration (i.e., m= 45 days or m=180 days for within treatment and posttreatment analyses, respectively).

Within the context of survival analysis, the hypothesis corresponding to Contrast 1 predicts longer durations until first day of heavy drinking (i.e., longer survival) for clients with higher psychopathology levels when treated with CBT as opposed to MET. The hypothesis associated with Contrast 2 predicts that clients with higher levels of psychopathology will experience longer survival when given CBT rather than TSF. These two contrasts were tested using a Bonferroni-corrected alpha level (i.e., α=0.05/2=0.025).

Table 4 portrays the sample size and the percentage of individuals who did not engage in any heavy drinking for each of the analyses described above (i.e., the percentage of clients who survived). Differing numbers of clients were administered the ASI and C–DIS instruments, which accounts for the varying sample sizes within each study arm. The percentage of clients surviving within a given arm by time window combination was almost identical across analyses of the ASI and C–DIS samples. Clients in the outpatient arm were significantly less likely to survive than clients in the aftercare arm. This finding held in both within-treatment ($\chi^2(1)$=16.5, $p\leq$.001) and posttreatment ($\chi^2(1)$= 7.05, $p\leq$.008) time windows for the ASI sample.

Analogous differences were found in the C–DIS sample. Clients were also less likely to survive during the longer posttreatment window relative to the shorter within-treatment window. This difference was tested using McNemar's corrected chi square (Edwards 1948) and was significant in both the outpatient ($\chi^2(1)$=112.47, $p\leq$.001) and aftercare ($\chi^2(1)$= 205.52, $p\leq$.001) arms, corresponding to the ASI

Table 4. Sample sizes and percentage of individuals who did not engage in heavy drinking within the specified time period

	Within treatment		Post-treatment	
	ASI	C–DIS	ASI	C–DIS
Outpatient arm				
Sample size	947	870	947	870
Percent surviving	35%	36%	17%	16%
Aftercare arm				
Sample size	767	748	767	748
Percent surviving	58%	59%	27%	28%

NOTE: The percentage of individuals who survived does not include cases censored due to missing data on drinking outcomes.

sample. Again, the same pattern of significant results was found for the C–DIS sample.

Table 5 describes the interaction effects from the Cox regression models that were analyzed. Reliable matching effects were limited to those examined in the C–DIS sample. Specifically, a matching effect for the CBT versus MET contrast was statistically significant in the analysis of outpatients within treatment. In this effect, CBT led to much better survival than did MET when clients exhibited a psychiatric diagnosis; however, the two treatments produced statistically similar outcomes when no diagnosis was present. An analogous finding was observed for the CBT versus TSF contrast, although this contrast only reached trend levels. In this instance, CBT led to better survival than TSF when considering clients with a C–DIS diagnosis. Figure 3 illustrates these two findings with survival curves developed from the Kaplan-Meier (1958) estimates.

Table 5. Survival analysis interaction effects based on models containing current DSM–III–R diagnosis from the Computerized Diagnostic Interview Schedule and the Addiction Severity Index

Treatment		Within treatment				Posttreatment			
		MV × Tx		MV × Tx × T		MV × Tx		MV × Tx × T	
		ASI	C-DIS	ASI	C-DIS	ASI	C-DIS	ASI	C-DIS
Outpatient arm									
CBT vs. MET	χ^2	1.19	6.27	0.09	3.63	1.02	2.13	0.80	1.59
	p	.28	**.01**	.77	.06	.31	.14	.37	.21
CBT vs. TSF	χ^2	0.11	4.03	2.10	2.27	0.90	0.03	0.01	0.01
	p	.75	**.04**	.15	.13	.34	.86	.92	.93
Overall	χ^2	1.24	6.80	2.42	3.90	3.60	3.12	0.95	2.33
	p	.54	**.03**	.30	.14	.17	.21	.62	.31
Aftercare arm									
CBT vs. MET	χ^2	0.70	0.97	0.68	2.34	0.77	0.19	0.23	1.98
	p	.40	.33	.41	.13	.38	.66	.63	.16
CBT vs. TSF	χ^2	0.27	0.00	1.74	4.24	2.43	0.00	2.22	0.27
	p	.60	.99	.19	.04	.12	.98	.14	.60
Overall	χ^2	0.70	1.25	1.75	4.35	5.60	0.23	4.19	2.03
	p	.70	.54	.42	.11	.06	.89	.12	.36

NOTE: MV = matching variable, C–DIS and ASI; Tx = treatment, T=time. All p values are nondirectional and should be halved to determine p values for a directional hypothesis test. All chi-square values are Wald chi squares. Contrasts were 1 degree of freedom tests whereas tests involving the overall attribute by treatment interaction effect possessed 2 degrees of freedom.

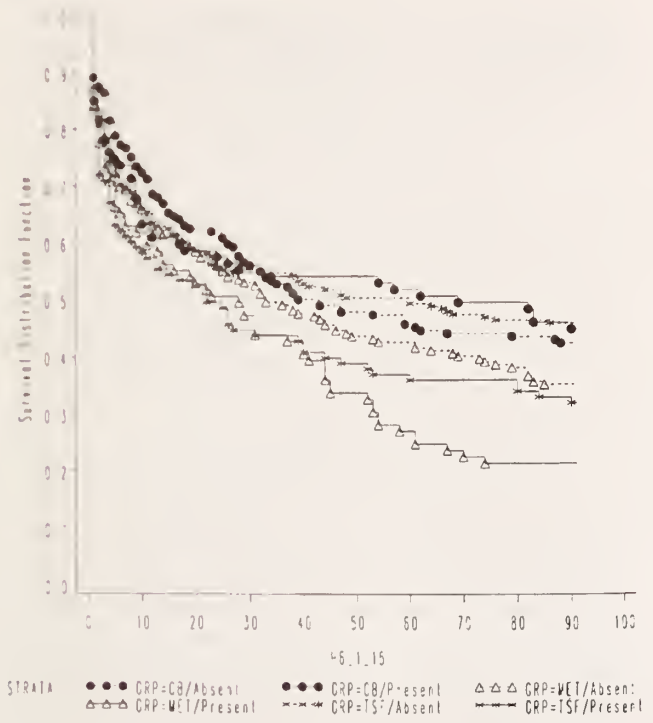

Figure 3. Survival curves for the CBT versus MET matching contrast. Relapse defined as time until first day of heavy drinking.

Matched Versus Mismatched Clients

Another way to determine the magnitude of the observed psychopathology matching effects is to compare outcomes for outpatient clients after dividing all of them into matched or mismatched groups. Descriptive analyses were conducted based on the ASI latent growth results and the C–DIS survival analyses. In the first analysis, high psychopathology clients were considered matched when they were assigned by randomization to CBT and mismatched when assigned by randomization to TSF, while low psychopathology clients were considered matched when assigned to TSF and mismatched when assigned to CBT.

All clients in the outpatient sample were divided into low and high psychopathology groups, with the cut point based on the ASI Psych score at the intersection point in figure 2. Clients with scores less than 0.4 were classified low psychopathology and those with scores greater than or equal to 0.4 were classified high psychopathology. Outcome was examined using a composite outcome variable based on drinking data from the Form 90 (Miller 1996) and alcohol-related negative consequences from the DrInC questionnaire (Miller et al. 1995; see Zweben and Cisler 1996 for a description of the composite outcome variable). Outcome was classified as "success" when a client reported no heavy drinking or alcohol-related negative consequences in the preceding 3 months. Outcome was classified as "failure" when a client reported any heavy drinking and/or consequences in the prior 3 months. Figure 4 suggests that the ASI psychopathology matching effect may actually be a pseudo matching effect because the outcome of the matched group is no better than the outcome of the group of clients all assigned to TSF.

The second descriptive analysis was based on the significant matching effects found in the survival analysis of the C–DIS matching variable. C–DIS positive clients were considered matched when they were assigned by randomization to CBT and mismatched when assigned by randomization to MET, while C–DIS negative clients were considered matched when assigned to MET and mismatched when assigned to CBT. Figure 5 reveals a large matching effect on composite outcome during the treatment phase. Matched clients had more than a 20-percent higher success rate than unmatched or randomly assigned clients.

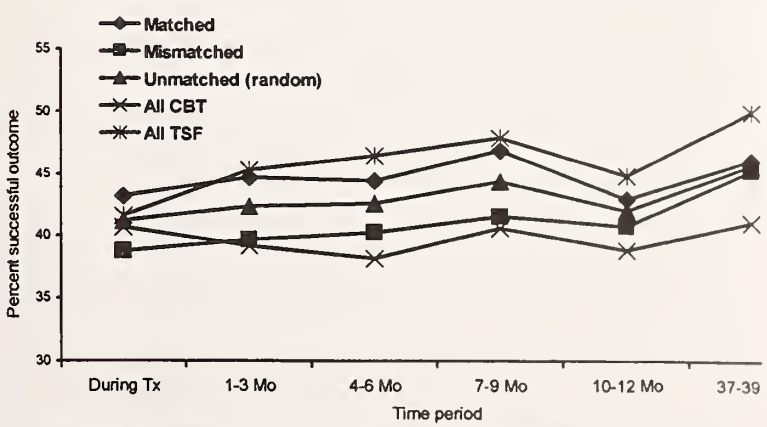

Figure 4. Matching to CBT versus TSF based on intake ASI Psychiatric composite scores in the outpatient arm across treatment and followup. Clients with ASI scores <0.4 were matched to TSF; those with scores ≥0.4 were matched to CBT.

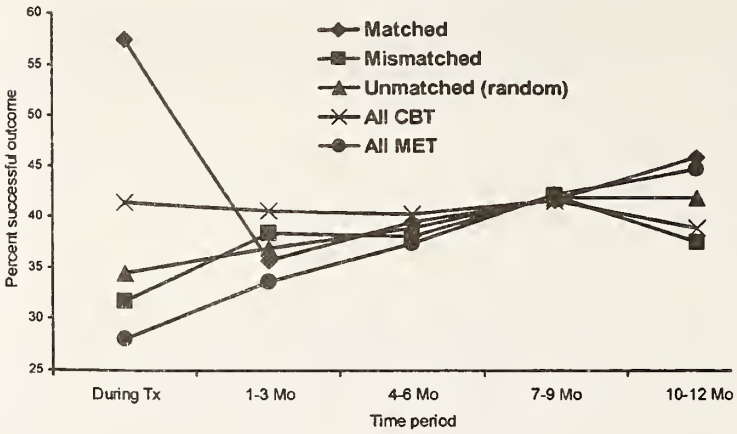

Figure 5. Matching to CBT versus MET based on intake C–DIS Axis I diagnosis in the outpatient arm across treatment and followup. C–DIS positive clients were matched to CBT; C–DIS negative clients were matched to MET.

Testing the Causal Chain

The a priori psychopathology matching hypothesis predicted that greater pretreatment psychopathology scores would be associated with greater differential effectiveness of CBT relative to TSF. A causal chain was hypothesized that CBT treatment contained specific elements that addressed the needs of individuals with higher psychopathology, resulting in a reduction in symptoms in these individuals, which in turn led to reduced drinking after treatment. Results are presented that examine the following links in the causal chain:

- Is there a greater emphasis on addressing psychological symptoms in the CBT treatment sessions than in the TSF sessions?
- Is there a lower level of posttreatment psychological symptoms in the CBT condition than in the TSF condition, controlling for pretreatment psychological symptoms?
- Is the level of posttreatment psychological symptoms predictive of drinking outcomes in the 12 months following treatment?
- Are clients who relapse in the CBT condition less likely to attribute their first drink to a negative mood state than are clients who relapse in the TSF condition?

Is there a greater emphasis on addressing psychological symptoms in the CBT treatment sessions than in the TSF sessions? The assessment of treatment process in Project MATCH used methodology adapted from the NIMH Collaborative Study on Treatment of Depression (Elkins et al. 1985). Every Project MATCH session was videotaped, and Likert-type items for rating these tapes were generated from treatment manuals. After the MATCH Tape Rating Scale (MTRS) was developed, all Week 2 session tapes and a randomly selected subsample of 150 Week 6 session tapes were rated (see Carroll et al. 1998 for a detailed description of the MTRS).

The MTRS included the following item, "To what extent did the therapist explicitly focus on the client's psychopathology or problems in emotional or behavioral functioning?" The mean rating on this item was examined by treatment for the complete sample as well as on a subsample of clients with high pretreatment psychopathology. Ratings on this item were generally low, with 73 percent of aftercare sessions and 76 percent of outpatient sessions rated "not at all" for Week 2.

Analysis of variance showed no significant difference among CBT, MET, and TSF clients for this item at either Session 2 or Session 6 in the aftercare or outpatient arm. An analysis of the subsample of cases with high pretreatment psychopathology also found no significant differences among treatments for either arm at Session 2. However, it is possible that therapists did not have time to focus on psychopathology early in treatment with clients who were still drinking. Greater focus on psychopathology may have occurred later in treatment, when abstinence permitted clearer assessment of psychopathology.

Another analysis examined the frequency of occurrence of the optional psychopathology-focused CBT sessions in the low and high psychopathology samples. These optional sessions were Awareness of Anger, Anger Management, Awareness of Negative Thinking, Managing Negative Thinking, and Managing Negative Moods and Depression. Although psychopathology sessions were more frequently delivered to high psychopathology clients, these elective sessions made up only 11.2 percent of all sessions in the outpatient arm and 14.8 percent of all

sessions in the aftercare arm. This occurred because the CBT treatment manual specified that eight core sessions dealing with alcohol-related coping skills should be delivered before any elective sessions were delivered.

Is there a lower level of posttreatment psychological symptoms in the CBT condition than in the TSF condition, controlling for pretreatment psychological symptoms? A series of analyses of variance, controlling for site, site by treatment, and pretreatment ASI Psych scores revealed that the mean ASI Psych scores for the CBT, MET, and TSF conditions were not significantly different for the outpatient or aftercare arm at the end of treatment or at 6 and 12 months after treatment (all p's >.1). A parallel analysis was done using pretreatment and posttreatment scores on the Beck Depression inventory, again with no significant differences among treatments. Thus, there was no evidence of greater reduction in psychopathology among participants in the CBT condition.

Is the level of posttreatment psychological symptoms predictive of drinking outcomes in the 12 months following treatment? Four different repeated-measures analyses of covariance were conducted (aftercare and outpatient arms, PDA and DDD outcomes), adjusting for baseline drinking, site, treatment assignment, and site by treatment effects. Posttreatment ASI Psych was a significant predictor of drinking outcome only for DDD outcome in the outpatient arm (p= .013). Although they are significant, the prognostic effects are small, with posttreatment ASI Psych accounting for only 1 percent of variance in DDD outcome. The ASI Psych by time effect was significant for PDA and DDD in the aftercare arm, but post hoc analyses revealed that ASI Psych predicted drinking in only 2 or 3 of the 12 posttreatment months.

Somewhat stronger prognostic effects were found using the posttreatment scores on the Beck Depression Inventory (BDI). Posttreatment BDI predicted PDA and DDD in both the outpatient and aftercare arms (p's <.0001), accounting for approximately 3 percent of variance in outcome.

Are clients who relapse in the CBT condition less likely to attribute their first drink to a negative mood state than are clients who relapse in the TSF condition? An analysis was conducted to test the hypothesis that psychopathology symptoms are antecedent to relapse less often in the CBT condition than in the MET or TSF conditions. This analysis used only clients who reported a relapse in the followup interviews. The Reasons for Relapse Questionnaire was given at the 3-, 9-, and 15-month followups. This questionnaire contained three items pertaining to negative mood states as reasons for relapse: "feeling angry," "feeling down or blue," and "feeling uptight or anxious."

The means for each of these three items were not significantly different for clients in the CBT condition compared with clients in the TSF condition at any of the three followup interviews, in either the outpatient or aftercare arm of the study. This analysis was also conducted on a subsample of clients with high ASI Psych scores at pretreatment (≥0.4). The results were also nonsignificant, but the sample size for the t-tests ranged from 14 to 28 per cell. This is because only clients with high pretreatment ASI scores who reported relapse in the followup period were entered into the analysis. Based on these analyses, there is no evidence that the CBT condition was associated with fewer relapses triggered by negative mood states compared with the MET or TSF conditions.

Summary

Based on causal chain results from the outpatient arm, there is some evidence to support the link in the causal chain that psychopathology at the end of treatment causes drinking in the following year. However, there is no evidence in either the outpatient or aftercare arm to support the link in the chain that CBT causes more reduction in psychopathology than does MET or TSF. It appears that both CBT and TSF were associated with decreased psychopathology, perhaps secondary to reductions in drinking.

Alcoholics Anonymous Attendance as a Mediator

A new causal chain hypothesis was developed after reviewing results showing that clients without psychopathology had better outcomes when assigned to TSF rather than CBT. This

chain focused on AA attendance as a mediator of psychopathology matching.

We predicted that individuals without psychopathology would have a higher rate of AA attendance than those with psychopathology. If frequency of AA attendance were related to drinking outcome, then the group that went to the most AA meetings (i.e., low psychopathology, TSF clients) would have the best outcome. This would explain our psychopathology matching findings.

Does pretreatment ASI Psych predict AA meeting attendance during and/or after treatment? Pretreatment ASI Psych was not significantly related to AA meeting attendance during or after treatment in either the aftercare or outpatient arm. The pretreatment ASI Psych by treatment interaction effect on AA attendance was also nonsignificant, indicating that ASI Psych did not predict AA attendance differentially across the three treatments.

Pretreatment ASI Psych was also not a significant predictor of scores on the AA Involvement scale (Tonigan 1996) obtained at posttreatment. We found no evidence to support the idea that psychopathology interfered with AA affiliation.

Does AA attendance during outpatient treatment predict followup drinking? Across the three treatments, AA attendance during treatment predicted PDA at every month in the year after outpatient treatment, accounting for a small but statistically significant 1 to 4 percent of the variance.

Conclusions. We found that AA attendance predicted PDA, especially in the third month of treatment. However, we did not find ASI Psych to be predictive of AA attendance at any point in any treatment. Therefore, AA attendance could not function as a mediator of the psychopathology matching effect.

We also failed to find any moderator effects. There were no significant 3-way interaction effects of ASI Psych by AA attendance by Treatment. None was found with either all three treatments or with the CBT/TSF contrast. We also examined ASI Psych by AA attendance within-treatment (month 3) interactions, and none was found to be significant.

Discussion

In the primary outcome analyses, a single psychopathology by treatment interaction effect was found that met criteria for a Bonferroni-corrected level of significance. This was in the outpatient arm, contrasting CBT and TSF treatments using the PDA outcome. Clients without psychopathology on the ASI reported 87 percent abstinent days in the posttreatment period when assigned to TSF compared with 73 percent abstinent days reported by those assigned to CBT. The TSF advantage over CBT disappeared in clients with psychopathology.

The interpretation of this matching finding is clouded by the fact that Bonferroni-corrected significance levels were not achieved with the CBT–TSF contrast for interaction tests involving either posttreatment DDD outcomes, within-treatment PDA or DDD outcomes, or any contrasts with psychopathology defined as presence of a comorbid Axis I disorder on the C–DIS. Also, no psychopathology-related contrast was significant in the aftercare arm, and none of the a priori contrasts involving CBT versus MET was significant in either the outpatient or aftercare arm. When one statistical test out of many is found to be significant, there is the possibility that the significant finding is a type-1 error.

A descriptive analysis comparing matched versus mismatched groups of outpatient clients suggested that the ASI Psych matching effect may be a pseudo effect because the matched clients fared no better than the clients assigned to TSF. There is no reason to bother with assessing psychopathology with the ASI and providing access to alternative treatment approaches if equivalent outcomes can be achieved by assigning all clients to TSF.

Secondary outcome analyses using survival analysis of time to relapse also yielded only one significant result out of eight tests. This matching effect was also in the outpatient arm, but it involved the period during the active treatment phase rather than the year following treatment. Among clients with comorbid Axis I disorders, MET clients had a significantly higher relapse rate during treatment than CBT. The descriptive analysis of matched and mismatched clients suggests that this was a strong matching

effect, with the matching strategy based on the C–DIS resulting in an improvement of more than 20 percent in the rate of successful outcomes. Unfortunately, this matching approach did not improve outcomes after the termination of treatment. Nevertheless, these findings suggest that MET may not be the treatment of choice for individuals with psychopathology. The CBT advantage over MET with dual disordered clients may be more enduring if CBT treatment were extended beyond 12 weeks.

We were surprised by the lack of evidence for any enduring CBT advantage over the other treatments with high psychopathology individuals. Causal chain analyses shed some light on these results. Although the CBT manual contained many sessions addressing comorbid psychiatric symptoms, few of these sessions were delivered in Project MATCH due to the requirement that CBT therapists deliver the eight core CBT sessions to each participant before delivering any of the elective psychopathology-oriented ones. The mean number of sessions attended by CBT clients was approximately eight, so many clients were not in treatment long enough to receive an adequate dose of psychopathology-oriented treatment.

This interpretation is supported by the finding that videotape ratings revealed no differences among the three treatments in the degree of focus on psychopathology in Week 2. However, there may have been little time for therapists to focus on psychopathology during the highly structured second session. Moreover, most therapists may have waited to focus on psychopathology until later in treatment, when abstinence would have allowed clearer assessment of psychopathology.

Causal chain analyses did not help explain the finding of a TSF advantage over CBT for outpatient clients without psychopathology. Although we hypothesized that psychopathology might interfere with AA affiliation, there was no relationship between pretreatment ASI Psych scores and AA attendance or AA involvement. Clinical lore has it that clients with psychopathology do not affiliate successfully with AA. It is possible that the facilitation offered by the TSF therapists was sufficient to overcome barriers to AA affiliation for clients with psychopathology.

In the aftercare arm of the study, we did not find better outcomes among individuals without psychopathology in TSF treatment. The TSF advantage seen in the outpatient arm may have been diluted in the aftercare arm because most aftercare clients received recommendations to attend AA as a routine part of their inpatient or intensive outpatient treatment prior to entering Project MATCH aftercare treatment.

Another possible reason for the failure to find robust matching effects across study arms is that the psychopathology measures utilized in Project MATCH lacked sufficient reliability and validity. A study of the reliability of the ASI Psych composite score found that test-retest interrater reliability of the scale was lower than expected (Cooney, Carboneri, et al. 1997). The C–DIS has been found to overdiagnose individuals when compared with the Structured Clinical Interview for DSM–III–R and a consensus clinical diagnosis (Ross et al. 1994).

In conclusion, significant psychopathology matching interactions were found, but they were not consistent across outcome measures. The causal chain analyses did not reveal a mechanism of action for the matching interactions, further reducing confidence in the validity of the matching effects. With these limitations in mind, the following matching strategies are only tentatively recommended.

If one has the option of assigning outpatient clients to CBT or TSF, drinking outcomes after treatment may be improved by assessing clients with the ASI Psychiatric scale and assigning those with low scores to treatment utilizing the TSF approach rather than the CBT approach. Clients with higher ASI psychiatric severity may be assigned to either therapy. An equally effective alternative strategy would be simply to assign all clients to TSF rather than CBT.

Individuals with psychopathology treated with MET had significantly worse outcomes during the active treatment phase than those treated with CBT. This effect faded soon after termination of treatment. None of the Project MATCH therapies provided treatment with an extensive focus on reducing psychiatric symptoms, so results cannot be generalized to such forms of therapy.

Acknowledgments

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Sociopathy as a Client-Treatment Matching Variable

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ABSTRACT

Sociopathic personality and the diagnosis of antisocial personality disorder (APD) were evaluated as potential attributes that could differentially influence response to treatment. It was predicted that clients with sociopathy or an APD diagnosis would have better outcomes with Cognitive-Behavioral Coping Skills Therapy (CBT) than with Motivational Enhancement Therapy (MET) because of CBT's presumed lower reliance on the development of a working alliance between client and therapist, the inclusion in CBT of specific skills to manage anger, and the more structured nature of CBT. It was further hypothesized that those with APD or sociopathy would have better outcomes with Twelve Step Facilitation (TSF) than with MET because of the greater structure of TSF. Finally, CBT was hypothesized to be superior to TSF for these clients because it would teach them skills to manage their anger and because it does not require Alcoholics Anonymous (AA) attendance, which would be difficult for these clients to sustain. Only one of these predicted treatment contrasts was supported, and for only a very brief period of time, for just one of the outcome variables, and in only one arm of the trial. Furthermore, the hypothesized causal chains, relating client characteristics to outcome, for the most part did not operate as predicted: working alliance was not differentially effective for MET as opposed to CBT, treatment with CBT was not associated with a decrease in client anger, and MET was not found to be less structured than the other two treatments. However, attendance at AA was related to outcome, as expected, but contrary to expectation, those high in sociopathy or with APD attended AA at rates similar to other clients. The degree of anger reduction during treatment was also related to outcome, as predicted, but this effect was not limited to high sociopathy clients as had been anticipated. The failure to find matching of sociopathy or APD to any of the three treatments is at variance with two prior matching studies that did find matching with these client variables to CBT. Possible explanations for the failure to find matching effects are considered.

Sociopathy is often associated with alcoholism (Lewis et al. 1983; Mandell 1981). Alcoholics who exhibit antisocial personality traits are characterized by an earlier onset of excessive drinking and a more rapid progression to alcoholism than alcoholics who do not exhibit these traits (Hesselbrock et al. 1983). In addition, research suggests that sociopathy is a predictor of poor treatment outcomes among alcoholics. For example, Mandell (1981) documented a disproportionately high rate of dropout from alcoholism treatment by sociopathic clients, and Rounsaville et al. (1987) found that antisocial personality is one of several psychiatric disorders associated with poor treatment outcome among alcoholics.

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Other studies, however, suggest that sociopathy may not always lead to poor treatment outcome. Vaillant's (1983) long-term followup study found abstinence among 48 percent of those classified as both sociopaths and alcoholics, in contrast to only 28 percent of those without antisocial symptoms. Similarly, Longabaugh et al. (1994) found that alcoholics with antisocial personality disorder (APD) had better outcomes than non-APDs, as a main effect of treatment, when measured by percentage of days abstinent.

Rationale for Matching Hypothesis

A number of researchers have noted that sociopaths lack internal motivation and social skills and may be unable to develop good therapeutic relationships (e.g., Cleckley 1941; Gerstley et al. 1989). From these observations, it follows that therapies which rely upon the development of interpersonal relationships are likely to be less effective for sociopaths.

One treatment approach that does not rely heavily upon the quality of the relationship between therapists and clients, Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992), has been found effective with sociopathic alcoholics. Kadden and associates (1989) demonstrated significantly better outcomes among sociopathic clients treated with group CBT than nonsociopathic clients treated with this approach.

In contrast, sociopathic clients did less well than nonsociopathic clients when treated in an interactional group modality that relied heavily on the development of interpersonal relationships within the group. This pattern of results was maintained throughout a 2-year followup (Cooney et al. 1991). The Longabaugh et al. (1994) study is supportive of these findings: alcoholics with APD averaged fewer drinks per drinking day when treated with CBT than APD clients who were given relationally focused treatment. These two studies suggest that matching effects are likely when sociopathic clients are treated with CBT, as compared with alternative treatments that rely on interpersonal relationships as an active ingredient of treatment.

Structure is another attribute of treatment that is thought to be desirable for sociopaths (e.g., Frosch 1983). Among the treatments employed in the current study, CBT is considered to be highly structured. The Twelve Step Facilitation (TSF) approach is also structured, "with each session having a specific agenda and following a prescribed pattern" (Nowinski et al. 1992, p. 4). In this respect, these two treatments appear similar and stand in contrast to Motivational Enhancement Therapy (MET; Miller et al. 1992), which is viewed as being considerably less structured.

An additional similarity between CBT and TSF is that the therapeutic process of Alcoholics Anonymous (AA) has been identified as having, in part, a behavioral and cognitive focus (Brown 1993) that involves clear behavioral prescriptions and simple rules to help ensure abstinence. Miller (1978) has described specific areas of overlap between the approaches of AA and behavior modification.

Thus, there appear to be similarities between the structure and methods of the CBT and TSF approaches. As a result, similar effects of treatment were predicted for clients with sociopathy: they would have fairly good outcomes with either CBT or TSF, compared with MET.

There nevertheless are important differences between CBT and TSF despite the similarity in their degree of structure and in some of their methods. The specific content of CBT addresses skill deficits common among sociopathic alcoholics (e.g., skills for coping with criticism and anger), and improvements in these were expected to lead to reduced drinking. Therefore, sociopathic alcoholics, who were expected to enter treatment with fewer interpersonal skills, were predicted to show greater improvement with CBT than nonsociopathic clients. TSF treatment, on the other hand, was designed to facilitate attendance at AA meetings, which requires adequate interpersonal skills to develop relationships with peers at those meetings. However, since many sociopaths lack the social skills needed to develop positive interpersonal relationships, they were expected not to develop good relationships within AA groups, whereas nonsociopaths should have less difficulty doing so and would therefore benefit more from AA.

Sociopathy and Antisocial Personality

An additional issue in this study relates to identifying the best measure of sociopathy for matching purposes: whether the categorical diagnosis of Antisocial Personality Disorder provided by DSM–III–R would be as effective a matching variable as a continuous measure of sociopathy, such as that provided by the Socialization scale of the California Psychological Inventory (CPI–So; Gough 1987). Matching to the categorical diagnosis would be advantageous because the DSM diagnostic system is in widespread clinical use and is well understood by clinicians.

Although the discrete and continuous methods of assessing sociopathy are conceptually related, the content of the two constructs differs: the DSM–III–R APD diagnosis focuses on overt antisocial behaviors, whereas sociopathy measured with the CPI–So reflects a number of underlying characteristics (Kadden et al. 1996).

As a result, it was recognized from the outset that comparisons between them would reflect differences along two dimensions: (1) continuous measurement versus categorical diagnosis and (2) the differing foci of the two constructs. A comparison between them could provide important information regarding the type of assessment that would be the most useful clinically for matching clients to treatments but would not be able to ascertain whether any differences found were due to differences in scale type or scale content.

The two matching studies cited previously examined the role of the categorical APD diagnosis in client-treatment matching. Longabaugh et al. (1994) found matching based on this diagnosis. On the other hand, Kadden et al. (1989) did not find significant APD by treatment-type interactions but did find matching when they used the CPI–So scale to assess sociopathy.

It should be noted that while the Longabaugh et al. and Kadden et al. studies both included cognitive-behavioral treatments, those treatments nevertheless differed from one another in a number of aspects, and the studies employed different outcome measures.

The Hypothesized Matching Contrasts

The predictions for the two related constructs, sociopathy and antisocial personality diagnosis, were identical and are described below. Differences in treatment outcomes were predicted for three contrasts among the treatments.

CBT Versus MET Contrast

The MET treatment relies heavily on persuasive communications, which require a high degree of rapport between therapist and client, an alliance that is likely to be more difficult for sociopaths to form. In contrast, CBT requires less of clients in terms of rapport and communication skills, relying more on coping skills training and behavioral exercises. Mandell (1981) recommended that behavioral treatment programs should address specific skill deficits common among sociopathic alcoholics (see also Woody et al. 1985; Barley 1986). These elements (e.g., skills for dealing with criticism and anger) are included among the CBT coping skills modules. By comparison, MET does not emphasize the learning of new coping skills, and therefore the sociopath receiving MET is less likely to acquire them.

Statement of the Matching Hypothesis: *Drinking outcomes will be a function of an interaction between sociopathy/APD and treatment type, such that the slope of the regression line relating drinking outcome to sociopathy/APD will be greater for the CBT treatment condition than for MET.* This interaction is illustrated in Panel A of figure 1. Although this figure shows an intersection of the regression lines, this contrast makes no prediction regarding whether or where the lines might intersect.

TSF Versus MET Contrast

Given the similarities in the degree of structure of the TSF and CBT interventions, as compared with MET, similar predictions were made for the TSF versus MET contrast as were made for the CBT versus MET contrast.

Statement of the Matching Hypothesis: *Drinking outcomes will be a function of an*

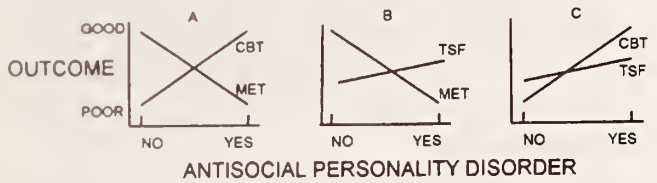

Figure 1. Predicted contrasts for Antisocial Personality Disorder for each of the three treatment pairings. The predicted contrasts for the sociopathy primary hypothesis are the same as those depicted for the APD hypothesis: simply substitute high or low levels of sociopathy for categorical diagnostic status (yes or no) on the abscissa of each panel.

interaction between sociopathy/APD and treatment type, such that the slope of the regression line relating drinking outcome to sociopathy/APD will be more positive for the TSF treatment condition than for MET. This interaction is illustrated in Panel B of figure 1, but here again no prediction was made regarding whether or where the regression lines might intersect.

CBT Versus TSF Contrast

Although it was expected that CBT and TSF would both be structured interventions, TSF differed from CBT in its reliance upon attendance at AA meetings. To benefit from AA, a client must possess adequate interpersonal skills to develop relationships with peers at those meetings, but many sociopaths lack those skills and would thus be unable to develop a positive relationship with an AA group. Assuming that attending and participating in AA meetings fosters sobriety, sociopaths will be less able to avail themselves of this resource and thus will have relatively poorer outcomes with TSF than with CBT.

Statement of the Matching Hypothesis: *Drinking outcomes will be a function of an interaction between sociopathy/APD and treatment type, such that the slope of the regression line relating drinking outcome to sociopathy/APD will be more positive for the CBT treatment condition than for TSF.* This interaction is illustrated in Panel C of figure 1. Again, no prediction was made regarding whether or where the regression lines might intersect.

Operationalization of the Matching Variable

The continuous measure for the sociopathy primary matching hypothesis was the CPI–So, a 46-item true/false inventory (Gough 1987). It was selected based on validity data and practical considerations (Cooney et al. 1990). Scores were inverted for analysis: higher values indicate greater sociopathy.

The categorical measure for the APD secondary hypothesis was the DSM–III–R Antisocial Personality Disorder diagnosis, as determined by the Computerized Diagnostic Interview Schedule (C–DIS; Robins et al. 1989). For analysis, a "1" was coded if the diagnosis was present and "0" if absent. These client variables were assessed at intake into the study.

Secondary Outcome Analyses

In addition to the two standard trialwide outcome variables (percentage of days abstinent and drinks per drinking day), it was also proposed to test two additional dependent variables: time to first drink and time to first heavy drinking day, based on prior matching findings with these variables (Kadden et al. 1989; Cooney et al. 1991).

Causal Chains

CBT Versus MET Contrast

Three causal chain analyses were proposed to account for this contrast.

Quality of the Therapeutic Relationship

The first examined the role of therapeutic alliance as a mediator of the matching effect. It was anticipated that sociopathic/APD clients would form relatively poor working alliances in all the therapies in this study, but the impact of this effect would be greatest in MET, which relies heavily on the establishment of good rapport between client and therapist. Although the poor quality of the working relationship would be present in CBT as well, that modality relies more

on skills training than on the relationship between client and therapist. Stated in the form of a logical syllogism, the causal chain is as follows:

- The more sociopathic the clients, the less their capacity to form a good therapeutic relationship.
- The less the clients' capacity to form a good therapeutic relationship, the less they will benefit from a therapeutic modality that relies on that relationship.
- MET treatment makes greater use of the therapeutic relationship than does CBT.
- The more sociopathic the clients, the less their success in MET, compared to CBT.

Quality of the therapeutic relationship was assessed by the Working Alliance Inventory (Horvath and Greenberg 1986) at the end of the second treatment session.

Anger

The second causal chain was based on improvement in the ability to manage anger as a mediator of the matching effect. It was anticipated that sociopathy/APD would be associated with higher anger ratings at baseline and that CBT, which addresses interpersonal skills in general and anger management specifically, would be associated with more decline in anger scores than MET. Among angry clients, greater reduction of anger from pretreatment to posttreatment would be associated with better treatment outcome. On the other hand, for those low in sociopathy (or without an APD diagnosis), it was expected that anger scores would be lower and therefore neither treatment would result in much change in anger. For these clients, then, there would be no relationship between change in anger and outcome.

The predictions were as follows:

- Sociopaths will have higher levels of anger at intake than nonsociopaths.
- Sociopaths will show more reduction in anger with CBT treatment than with MET.
- Among sociopaths, greater reduction of anger will be associated with better drinking outcome.
- Sociopathic/APD clients treated in CBT will have better outcomes than those treated in MET.

Project MATCH assessed anger at intake using the Spielberger Trait Anger Scale (TAS; Spielberger et al. 1983). Subjects scoring high on the TAS were assumed to have poor anger management skills.

Structure of Treatment

The final hypothesized causal chain for the CBT versus MET contrast examined the role of treatment structure as a mediator of the matching effect. It was expected that for sociopathic/APD clients, the greater the structure of treatment, the better the outcome. For nonsociopathic clients, it was predicted that treatment outcome would be independent of treatment structure. It was anticipated that CBT sessions would receive higher ratings on a treatment structure scale than MET sessions.

In syllogistic form, the causal chain is as follows:

- Sociopathic/APD clients will have a greater likelihood of benefiting from a more structured treatment approach than from a less structured one.
- Ratings of treatment sessions will show CBT to be more structured than MET.
- Sociopathic/APD clients will be more likely to benefit from CBT than from MET.

Treatment structure was measured as one of the subscales of the Project MATCH Tape Rating Scale (Carroll et al. 1998) by independent raters watching videotapes of each participant's second session of treatment.

TSF Versus MET Contrast

It was predicted that treatment structure would mediate the differences between the TSF and MET treatments for sociopathic/APD clients, who would have a greater likelihood of benefiting from a structured treatment. It was anticipated that ratings by independent evaluators would show TSF to be a more structured intervention than MET. Sociopathic/APD clients would therefore be more likely to benefit from TSF and less likely to benefit from MET. The sequence of logical steps for this proposition is the same as that specified for the preceding structure-of-treatment causal chain for the CBT versus MET contrast.

CBT Versus TSF Contrast

Two causal chain analyses were proposed to account for this contrast.

Anger

The first causal chain analysis tested whether change in anger would mediate the matching effect. In similar fashion to the anger causal chain for the CBT versus MET contrast, it was anticipated that sociopathy/APD would be associated with higher anger at intake, that CBT would be associated with greater decline in anger than TSF, and that greater reduction of anger among sociopaths would be associated with better treatment outcome. It was therefore predicted that sociopathic/APD clients would have better drinking outcomes with CBT than with TSF. The logical steps for this proposition are the same as those specified for the anger causal chain of the CBT versus MET contrast.

AA Attendance

The second causal chain for the CBT versus TSF contrast postulated that AA attendance would mediate the matching effect. It was expected that those with high AA attendance would have better treatment outcomes. It was predicted that sociopathic/APD clients would be less likely to engage with AA than nonsociopaths because of their difficulty forming meaningful interpersonal relationships. It was expected that AA attendance would generally be associated with good outcome in the TSF treatment but that sociopaths would be less likely to attend AA. It was therefore anticipated that among sociopathic/APD clients, treatment outcomes would be worse for those treated with TSF, as opposed to CBT, because of the heavy TSF reliance upon AA attendance, whereas the effectiveness of CBT does not depend upon AA.

The predictions were as follows:

- Clients with high AA attendance will have better outcomes.
- AA attendance depends in part upon the formation of interpersonal relationships.
- Because of their difficulty forming relationships, sociopaths will tend not to get involved in AA.
- TSF relies for its effectiveness upon AA attendance.
- Sociopaths will have poorer outcomes with TSF than with CBT because of their poor AA attendance.

Data on AA attendance were obtained at each followup assessment from the Form 90–F (Miller 1996).

Data Analysis

The primary tests of the matching hypotheses were conducted using hierarchical linear modeling (HLM) analyses. Separate analyses were performed for the period during which treatment took place (from intake to end of treatment, i.e., months 1–3), and for the period from end of treatment to the end of the 1-year followup (months 4–15). The primary dependent variables (DVs) in these analyses were (a) percentage of days abstinent (PDA, transformed to correct for nonnormal distributions) and (b) drinks per drinking day (DDD, also transformed), both of which were derived from Form 90 drinking assessments. Weekly values of these DVs were used in analyses for the 1–3 month period, and monthly values were used for the 4–15 month period.

The covariate set used for these analyses consisted of the pretreatment value of the drinking DV, a dummy variable representing the treatment site, the interaction of site by treatment type, and the interaction of site by treatment by sociopathy. Of the effects estimated, only the following were examined for the present report: main effect for sociopathy, time by sociopathy, quadratic effect of time ($Time^2$) by sociopathy, treatment site by sociopathy, time by treatment site by sociopathy, $Time^2$ by treatment site by sociopathy, sociopathy by treatment, time by sociopathy by treatment, and $Time^2$ by sociopathy by treatment.

A family-wise type-1 error rate of 0.05 was specified beforehand for each matching attribute. This was apportioned to each of the treatment contrasts specified for the hypothesis and was further divided by 2 to account for the two dependent variables. Significance levels for this hypothesis were partitioned among the three contrasts such that analyses involving the best

justified contrast (CBT versus MET) were required to meet an overall significance level of 0.015 (i.e., 0.03/2) and analyses involving the other two contrasts (CBT versus TSF and MET versus TSF) were each required to meet significance levels of 0.005 (i.e., 0.01/2). Main effects for treatment have been reported elsewhere (Project MATCH Research Group 1997*a*,*b*), and are not repeated here.

Results and Discussion

Results and discussion for the outpatient arm are presented first, followed by a similar presentation for the aftercare arm. Within each arm, matching results are presented in the following order: primary outcomes (PDA and DDD) during treatment, in the 1-year followup, and in the 3-year followup; secondary (time to event) outcomes; and causal chain findings. These are followed by discussion of the findings.

The presentation focuses primarily on the CPI–So client attribute, with additional comments referring to the APD client attribute (assessed by C–DIS), which was evaluated in the same manner as the sociopathy matching variable but in general had fewer findings.

Outpatient Arm—Results

1–3 Month Period

HLM analyses of PDA during the period in which the treatments were provided found no effects attributable to sociopathy nor to any interaction of sociopathy with treatment assignment or with time. However, with DDD as the DV, a main effect for sociopathy emerged, such that clients scoring high in sociopathy reported more drinks per drinking day than did those low in sociopathy ($F(1, 8656)=10.19$, $p<.01$).

There were no effects attributable to antisocial personality diagnosis nor any significant interaction of APD with treatment assignment or with time, for either of the dependent variables.

4–15 Month Followup Period

A significant interaction of sociopathy with linear time was found ($F(1, 7857)=10.03$; $p< .01$) with the PDA dependent variable. Examination of monthly means indicated that clients high in sociopathy maintained a fairly constant level of PDA throughout the followup period while those low in sociopathy fared progressively worse over the course of the followup year. This effect can be seen across the three panels of figure 2. No significant effects were found for any predicted interaction of sociopathy with treatment assignment. However, there was a finding in the unexpected direction for the CBT versus MET contrast ($F(1, 6298)=3.07$, $p=.04$): clients treated in CBT who were *low* on CPI–So sociopathy had higher PDA than clients with high sociopathy or clients treated in MET. With DDD as the dependent variable, no significant effects of any kind were seen.

Furthermore, no effects involving APD, either alone or in interaction with treatment type or with time, reached significance for either the PDA or DDD primary dependent variables.

3-Year Followup

Followup data were collected for outpatient subjects at 3 years posttreatment. Drinking data were averaged across months 37–39 (timed from the date of intake into the study) to provide one value for each of the two primary dependent variables, PDA and DDD (Project MATCH

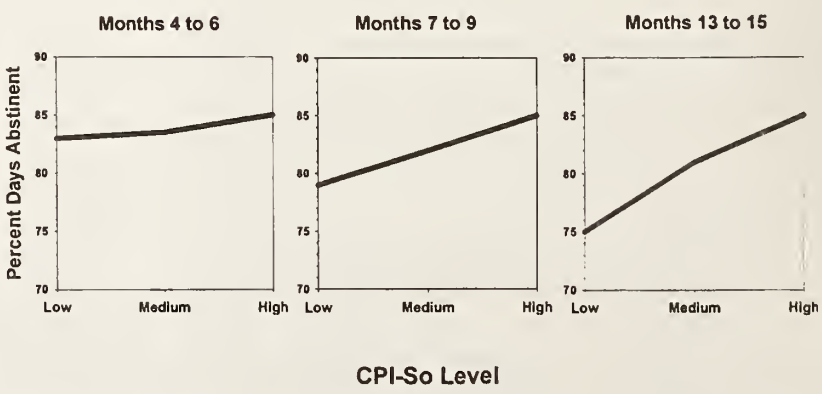

Figure 2. Percentage of days abstinent during three intervals of the followup period as a function of trichotomized sociopathy levels. Data are from the outpatient arm of the trial.

Research Group 1998). An analysis of covariance was performed for each dependent variable, using the same covariates as in earlier analyses. There was no significant effect of sociopathy nor an interaction of sociopathy with treatment assignment for either of the primary dependent variables at 3 years. Furthermore, neither APD nor the interaction of APD with treatment assignment was significant for either of the dependent variables.

Secondary Outcome Variables

In addition to examining data on the quantity (DDD) and frequency (PDA) of drinking, analyses were conducted to determine whether client-treatment matching might also be reflected in time until relapse. Two definitions of "relapse" were used: the most conservative one established the first drink after the beginning of treatment as a relapse, whereas the less conservative definition established the first heavy drinking day after the beginning of treatment as a relapse. Cox model regression analyses were used to determine the effect of CPI sociopathy on time to relapse measured in days since the beginning of treatment. The same was done for the interaction of treatment with sociopathy. In these analyses, the covariates were pretreatment levels of both primary drinking variables as well as terms representing site, treatment, and the interaction of site by treatment.

In the analysis of time to first drink, no significant effects were found for CPI sociopathy, for treatment, or for the interaction of treatment by sociopathy. However, in the analysis of time to first heavy drinking day, a main effect was found for CPI sociopathy (risk ratio=1.015, $p<$ .05), such that those higher in sociopathy reached a heavy drinking day sooner than those lower in sociopathy. No effects on time to first heavy drinking day were found for treatment or for the interaction of treatment with sociopathy.

No significant effects were found for APD, treatment, or the interaction of APD by treatment in analyses of time to first drink or time to first heavy drinking day.

The A Priori Causal Chains

The matching hypotheses were formulated based on certain assumptions regarding treatment processes and the action of mediating variables; these were specified in terms of causal chains. An example of how these causal chains were operationalized is shown in figure 3 for the differential effects of MET and CBT with respect to the working alliance mediating variable. In this model, sociopathy, measured by the CPI–So, was expected to be inversely related to working alliance; hence the minus sign above and below the arrows (for the outpatient and aftercare arms, respectively) in the left portion of the figure, for both the MET and CBT treatments. Moving to the right in the figure, it was anticipated that working alliance would be conditionally predictive of outcome, depending on the treatment delivered. Because the outcome of MET was expected to be positively related to the development of a working alliance, the proposed relationship between working alliance and outcome was depicted as positive in the upper half of the model by means of four separate terms, one for each of the two dependent variables in both arms of the study.

The terms that appear above the arrow represent the path coefficients for the outpatient arm. Those for the aftercare arm are below the arrow. The first term of each pair indicates the relationship to the PDA outcome; the second term, in parentheses, indicates the relationship to the DDD outcome. The plus sign above the second arrow suggests the anticipated positive relationship between working alliance and the PDA outcome, and the minus sign indicates the anticipated negative relationship between working alliance and the DDD outcome. The same relationship between working alliance and outcomes was predicted for MET clients in the aftercare arm, as indicated by the signs below the arrow. For CBT, however, outcome was expected to be independent of working alliance, and therefore the relationship between working alliance and outcome was expected to be nonsignificant (ns).

The differential impact of sociopathy on treatment outcome during the followup period was analyzed using maximum likelihood structural equations modeling procedures. The two primary outcome variables, PDA and DDD over months 4 through 15, were modeled as latent outcome variables: for each dependent variable, a single latent variable was created, based on

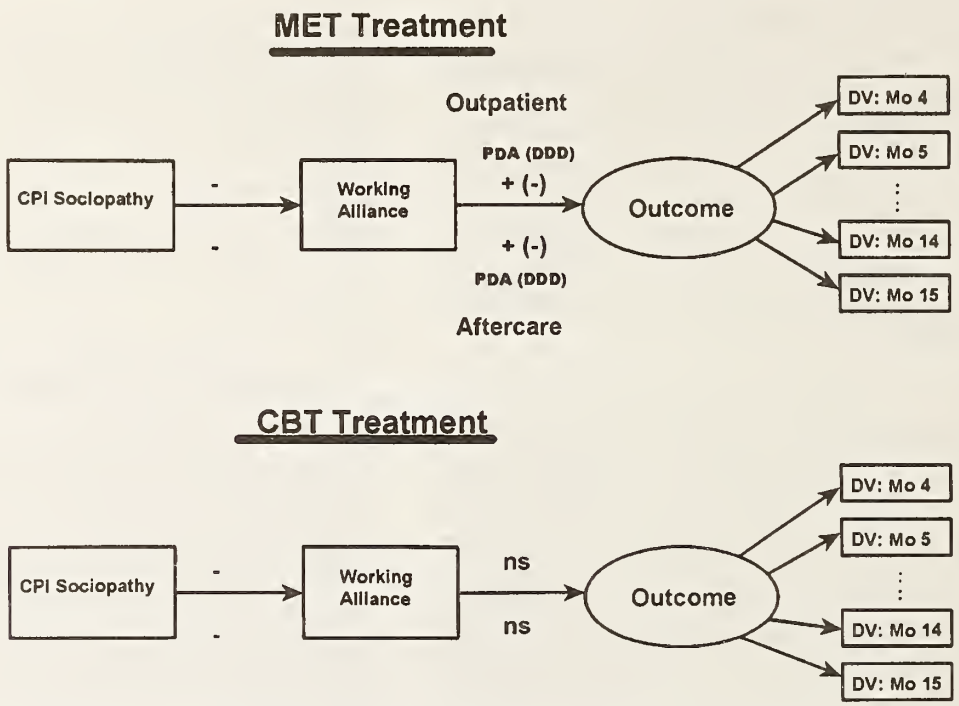

Figure 3. Generic model of a causal chain. This example depicts expected client-treatment matching effects when contrasting the CBT and MET treatments, with working alliance as the mediating variable.

the measures from each of the 12 followup months (indicated by the arrows on the far right in figure 3). The multiple dependent variables that make up the latent outcome variable were each weighted according to their relative contributions to the overall outcome measure. This process was repeated for each of the dependent variables, across all six a priori causal chains that were proposed to account for the hypothesized impact of client sociopathy or APD on the outcomes of the three different treatments.

It should be noted at the outset that these models did not provide a good fit to the data obtained: the goodness-of-fit indexes (GFI), which should be close to 1.00, were at best about 0.85, with no more than 20 percent of the variance in outcome accounted for by any of them.

The results for the APD client attribute paralleled those for CPI-sociopathy as the matching variable, but tended to be weaker. Therefore, we have elected to present causal chain results only for the sociopathy client attribute.

Causal Chain Analyses

CBT Versus MET Contrast. The first causal chain for this contrast involved working alliance, as illustrated in figure 3. Results of the analyses for this chain are shown in figure 4. Path coefficients are interpreted as betas (standardized regression weights) in these models.

A key assumption underlying the working alliance causal chain is that clients who are high in sociopathy will have poorer social skills than those low in sociopathy. Although Project MATCH included no direct measures of social skills, CPI sociopathy was found to be negatively correlated with the Social Behavior and Overall Social Role Performance subscales of the Psychosocial Functioning Inventory (Feragne et al. 1983) and with length of residence, an indicator of social stability (r's=−0.40, −0.30, and −0.15, respectively). These correlations suggest that clients who are higher in sociopathy do seem to have less social competence and less social stability than clients with low levels of sociopathy.

Nevertheless, despite that relationship, CPI–So scores were only moderately inversely related to working alliance (path coefficients= −0.18 and −0.15). Working alliance, in turn, was not predictive of outcome for MET clients but was significantly predictive of outcome for CBT

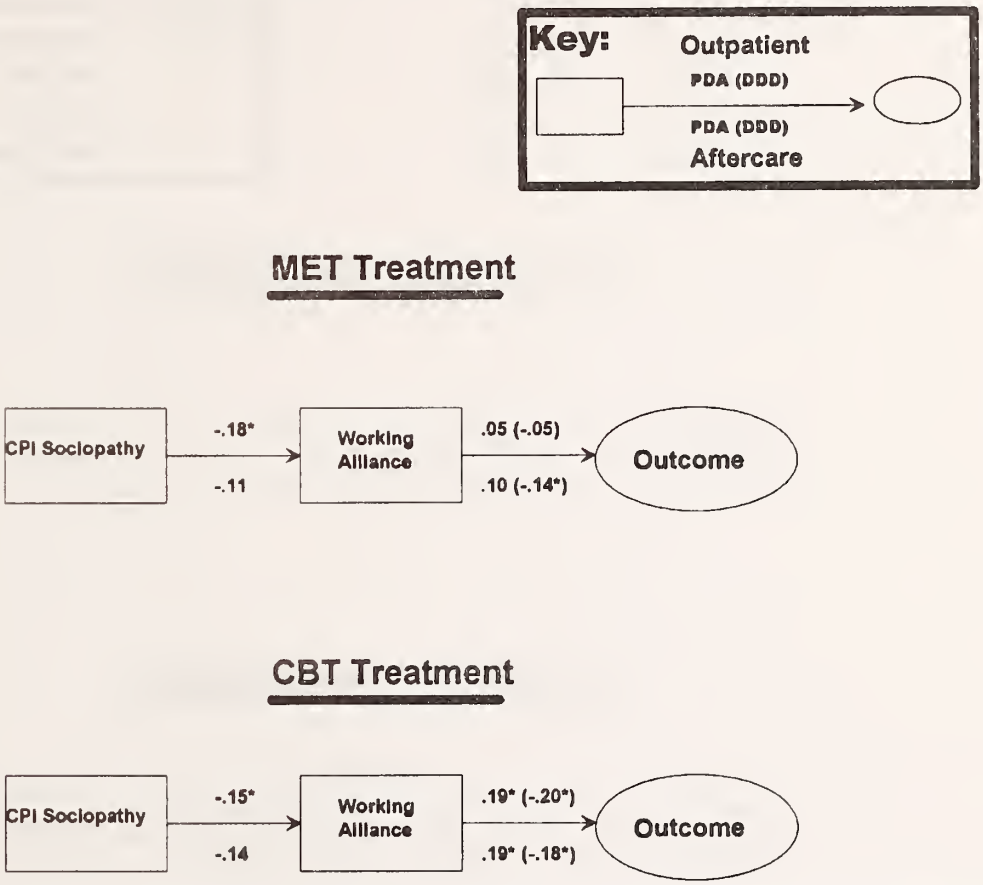

Figure 4. Results of causal chain analysis of CBT versus MET contrast with working alliance as the mediating variable. *$p<.05$

clients. This result, contrary to our expectations, is consistent with the CPI–So by treatment interaction in the unexpected direction noted above in which CBT clients scoring *low* on sociopathy had better outcomes (higher PDA). CBT clients who scored low on sociopathy were more likely to have a better working alliance (path coefficient=−0.15), and higher alliance scores were related to better PDA outcome (path coefficient=0.19).

A second causal chain that was proposed for the CBT versus MET contrast involved the differential effect of treatment on client anger. The underlying assumption was that high-sociopathy clients would be more angry than those low in sociopathy and would therefore be more likely to benefit from a reduction in anger. The initial part of that assumption was borne out: CPI sociopathy was significantly correlated with pretreatment anger (r=0.38). Those high in sociopathy had a mean trait anger score of 33.3, whereas those low in sociopathy had a mean score of 26.7. The causal chain analyses regarding anger change are shown in figure 5. The model tests the proposition that treatment assignment (CBT versus MET) predicts change in anger, which in turn predicts outcome. In this model, low sociopathy clients were those scoring in the lowest third of the distribution of CPI–So scores, and high sociopathy clients were those in the highest third. Anger change in these analyses was calculated as the posttreatment anger score with pretreatment anger partialed out. A positive value for this term represents a *decrease* in anger from pretreatment to posttreatment.

Contrary to our expectations, treatment differences had no effect on change in anger for those high in sociopathy but had a modest paradoxical effect for outpatients low in sociopathy (path coefficient=−0.21): CBT was associated with an *increase* in anger (CBT was coded +1 and MET coded −1 in these analyses). In the

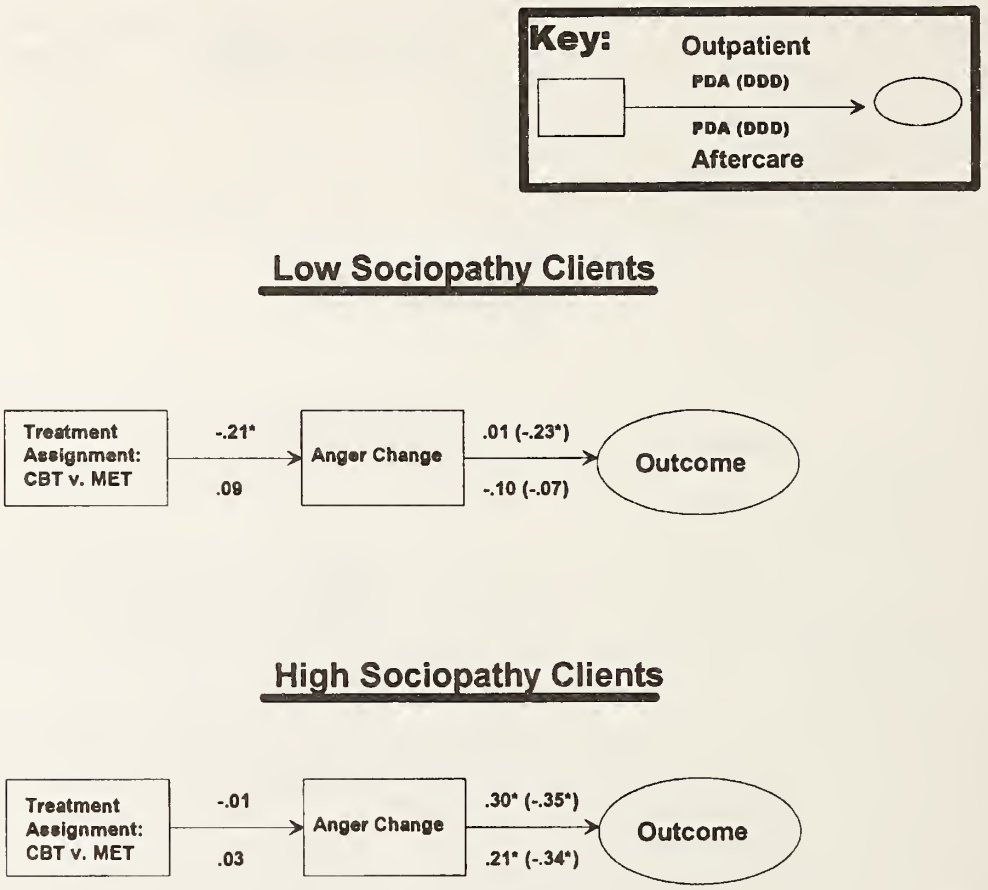

Figure 5. Results of causal chain analysis of CBT versus MET contrast with anger change as the mediating variable, at low levels of sociopathy (bottom third of clients) and high levels of sociopathy (top third of clients). *$p<.05$

second link of the causal chain, as expected, a decrease in anger was associated with better PDA and DDD outcomes among high sociopathy clients and with better DDD among low sociopathy clients.

A third hypothesized causal chain involved therapy structure, positing that structured therapy would improve outcome for clients high in sociopathy. However, as shown in figure 6, treatment assignment made no difference in raters' judgments of therapy structure: MET sessions were rated as being about as structured as the CBT sessions (the path coefficients for low and high sociopathy clients, -0.22 and 0.04, respectively, were nonsignificant). At both levels of sociopathy, therapy structure was not related to treatment outcome, with one exception: greater structure was associated with fewer DDD, but only for low sociopathy clients, not for high sociopathy clients as had been forecast.

TSF Versus MET Contrast. For the TSF versus MET contrast, treatment assignment did have some impact on ratings of therapy structure (figure 7), with TSF rated as more structured than MET, but only among clients low in sociopathy (path coefficient=0.27). The only relationship between therapy structure and outcome, as in figure 6, was a fairly strong one (path coefficient=-0.73) for the DDD outcome among low sociopathy clients.

TSF Versus CBT Contrast. Sociopathy had been expected to be inversely related to attendance at AA, but as seen in figure 8, it had no association with AA attendance (path coefficients=0.09 and -0.14). Nevertheless, AA attendance was strongly predictive of outcome, even for clients in the CBT treatment condition (absolute value of all path coefficients ≥ 0.33). This was the only model that accounted for significant amounts of outcome variance (average

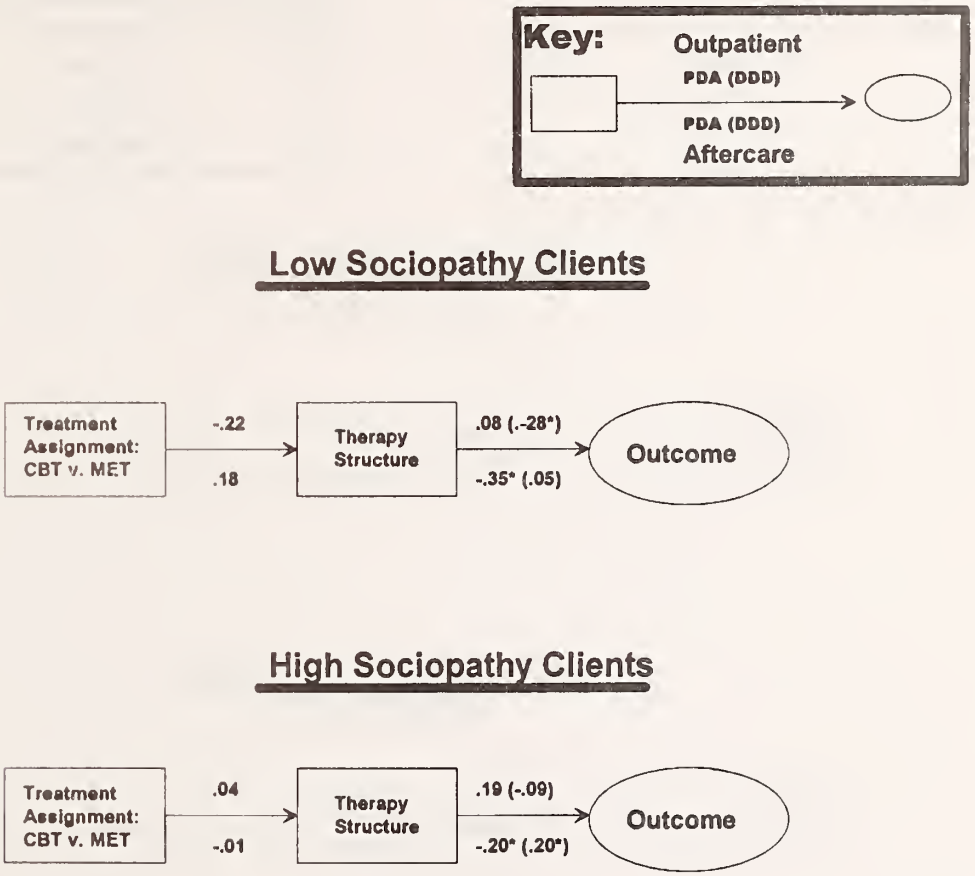

Figure 6. Results of causal chain analysis of CBT versus MET contrast with therapy structure as the mediating variable, at low levels of sociopathy (bottom third of clients) and high levels of sociopathy (top third of clients). *p<.05

multiple R^2=0.45), although as with all the other models, its overall fit to the data was poor for all four analyses (average GFI=0.75).

Finally, change in anger was also hypothesized to be a mediator of treatment effect for the CBT versus TSF contrast, with those higher in sociopathy expected to benefit more from anger reductions, which would be more likely to occur with CBT. In these analyses, however (data not shown), CBT was not superior to TSF in reducing anger (average path coefficient=0.06), and anger change was not related to outcome (average path coefficient=0.15).

Outpatient Arm--Discussion

Prognostic Effects of Sociopathy/APD

A main effect of client sociopathy on the DDD outcome was observed during the 3-month treatment period: as expected, sociopathic clients drank more on each drinking occasion. However, the only effect observed in the year following treatment was a sociopathy by time effect in which PDA became progressively worse among the less sociopathic outpatients, a finding inconsistent with the effect during treatment and with what had been anticipated. Although some weakening of treatment effectiveness over time might be expected, these effects in the primary outcome variables were inconsistent: they were not observed in both outcome variables, and not with APD as the client variable.

However, one of the secondary time-to-event outcome measures (time to first heavy drinking day) was significant in both arms in the expected direction: clients with high levels of sociopathy reached a heavy drinking day more quickly. Combining this with the DDD within-

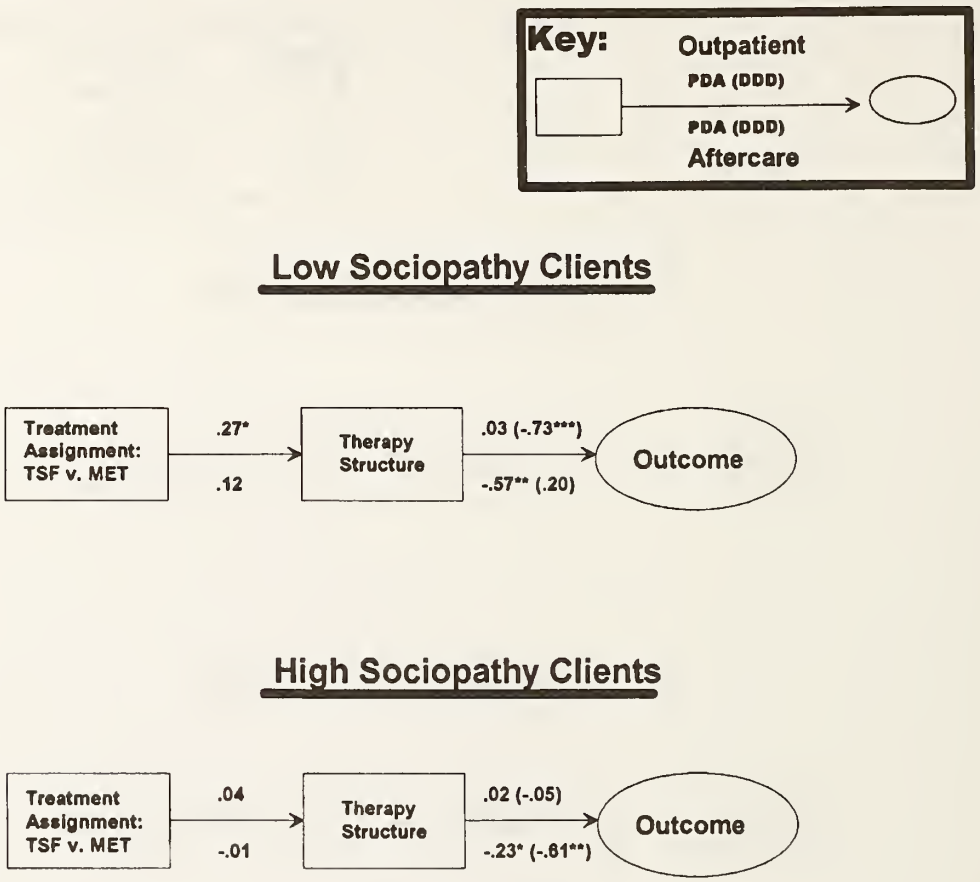

Figure 7. Results of causal chain analysis of TSF versus MET contrast with therapy structure as the mediating variable, at low levels of sociopathy (bottom third of clients) and high levels of sociopathy (top third of clients). *p<.05, **p<.01, ***p<.001

treatment finding suggests that clients who were more sociopathic were more likely to relapse sooner and to drink more when they did.

Inconsistencies in the present findings are reminiscent of those in the literature, where sociopathy is found to be a prognostic variable in some studies but not in others. This variability of findings may indicate that sociopathy is not as reliable an indicator of poor prognosis as has often been suggested, or at least that not all the variables relevant to understanding the impact of sociopathy on outcome have been identified (Longabaugh et al. 1994).

Treatment Matching Effects

In the outpatient arm, no matching effects were observed with any of the treatments and either the sociopathy or the APD client variables. This contrasts with the findings of Longabaugh et al. (1994) in an outpatient sample in which CBT was particularly effective for clients with an APD diagnosis.

Causal Chain Analyses

The causal chains had been proposed as a means of empirically testing the reasoning behind the matching hypotheses. In the event that a hypothesis was not confirmed, it was hoped that the causal chains might provide useful information as to why the hypothesis failed. In the case of the sociopathy/APD hypotheses, several rationales were offered to account for each of the proposed matching contrasts, which became the basis for a number of different causal chains.

Working Alliance. Among outpatients in both MET and CBT, high sociopathy was associated with poorer working alliance, as anticipated. However, poorer working alliance was predictive of poorer drinking outcomes (both PDA and DDD) in CBT but not in MET, where

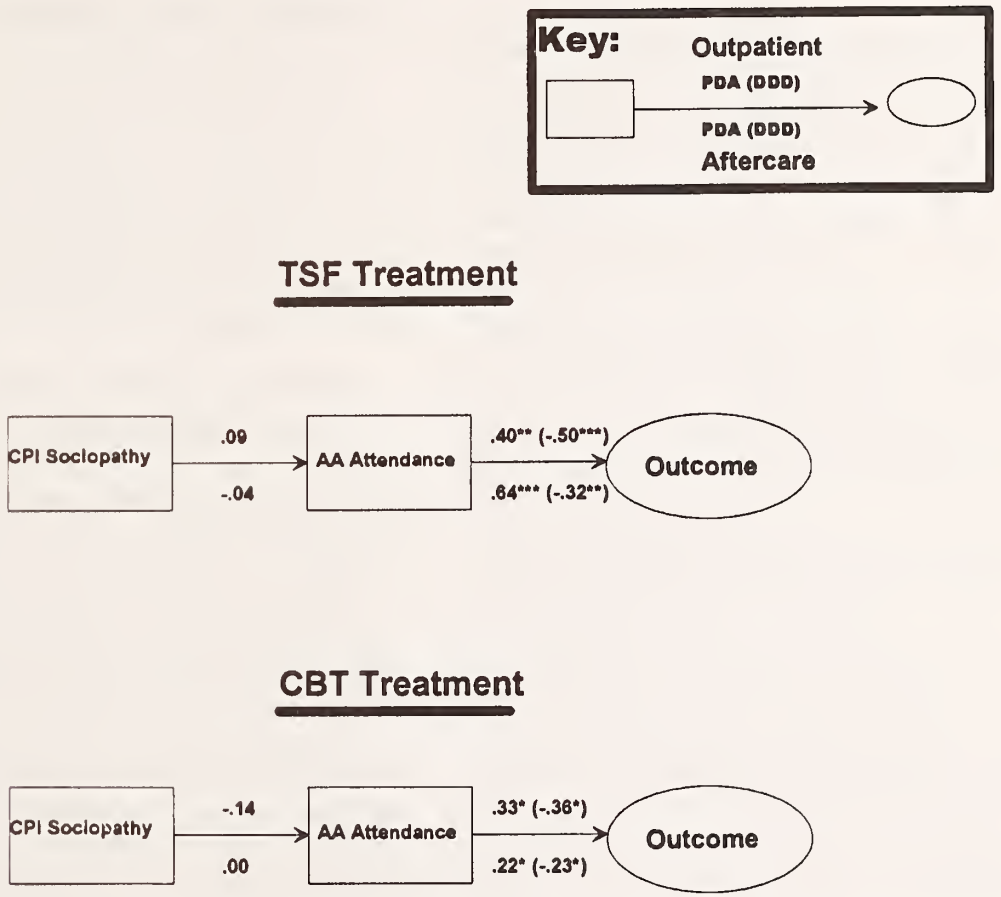

Figure 8. Results of causal chain analysis of TSF versus CBT contrast with AA attendance as the mediating variable. *p<.05, **p<.01, ***p<.001

this effect on outcomes had been anticipated. Thus, the a priori causal chain broke down because the findings in the second link were opposite to our prediction: CBT outcomes were associated with the strength of the working alliance whereas MET outcomes were not. Although it might be tempting, based on this, to recommend that clients high in sociopathy not be assigned to CBT, such a recommendation would contradict two prior findings in which sociopathic or APD clients had better treatment outcomes with CBT than did nonsociopaths/non-APDs (Kadden et al. 1989; Longabaugh et al. 1994).

Anger. As predicted, greater anger reduction was associated with a greater improvement in both PDA and DDD among high sociopathy clients. However, contrary to our predictions, this was also true among low sociopathy clients (for the DDD outcome), and the improvements in outcome occurred regardless of whether clients had been treated in CBT or MET. The causal chain failed because the anticipated differential benefit of CBT did not materialize. This may be due in part to anger management training having been an elective session, to be delivered in one of the last four sessions of CBT. However, by that time, many of the CBT clients had already dropped out of treatment: average attendance for outpatients in CBT was 8.27 sessions, and even fewer, 5.73, for those high in sociopathy. As a result, most clients missed the opportunity to receive the anger management session, perhaps explaining, in part, the lack of differential benefit of CBT for angry clients.

Structure. The causal chain based on treatment structure was not supported at any point. The independent raters did not view any of the three treatments as being more structured than the others, for the most part, and the relationship between the structure variable and outcome

was inconsistent. Among outpatient clients with low sociopathy ratings, there was a significant relationship with DDD (in the expected direction—greater structure was associated with lower DDD), but none with PDA. This was true for all three treatments. However, it had been expected that treatment structure would have greater impact on the *more* sociopathic clients rather than on those who were less sociopathic. The reasons for the inconsistency between the outcome measures, and the deviations from expectation, are not at all clear.

AA Attendance. The predicted relationship between sociopathy and AA attendance also did not materialize. Nevertheless, AA attendance was related to both outcome variables across all three treatments, and most strongly for TSF clients. This is consistent with Morgenstern et al.'s (1997) finding that client involvement in AA after formal treatment was associated with better outcomes. These findings speak to the benefit of recommending AA involvement for alcoholics in treatment, regardless of the therapeutic approach. However, it should also be noted that these studies provide no evidence as to whether AA would be sufficient by itself, without any other treatment.

Summary for Outpatient Arm. The data indicate that working alliance was more effective for CBT clients than for MET clients, CBT was not associated with a decrease in anger (but rather with increased anger for clients low in sociopathy), and all three treatments were found to be about equally structured. These findings are at variance with our a priori predictions.

The proposed causal chains failed in their first link, with one exception. Sociopathy was not associated with either the degree of anger reduction or the amount of involvement in AA, and the treatments were not rated as being more or less structured than one another, but sociopathy was associated with poorer working alliance, as anticipated. The causal chains performed a little better in their second link, where at least one of the outcomes was related to each of the mediating variables, although the only consistent relationship was between AA attendance and outcome across all three treatments and both outcome variables.

Aftercare Arm—Results

1–3 Month Period

No significant outcome effects emerged for sociopathy or for the interaction of sociopathy with treatment assignment or with time for either of the DVs during the period in which the treatments were provided. The same was true when the APD client attribute was substituted for sociopathy.

4–15 Month Followup Period

No significant effects of sociopathy or interactions of sociopathy with treatment type or time were found during the posttreatment year when either PDA or DDD was used as the dependent variable.

With respect to the APD analyses, no significant effects were found for any of the terms involving APD when PDA was the dependent variable. However, when DDD was the outcome, a significant interaction of APD by treatment by time was found ($F(2, 8119)=4.91$, $p<.01$). Examination of the means for DDD in each month of followup showed that early in followup, APD-positive clients who had been treated in CBT had fewer DDD than did APD-positive clients treated in TSF (as predicted), with no treatment differences for APD-negative individuals. This relative advantage for CBT disappeared after 2 months and reversed over time, so that by the end of month 15, APD-positive individuals tended to fare slightly (but not significantly) better if treated in TSF as opposed to CBT.

Secondary Outcome Variables

In the analyses of time to first drink, a main effect was found for CPI–So (risk ratio=1.025, $p<.05$) such that those higher in sociopathy tended to take their first drink earlier than those lower in sociopathy. However, no effects on time to first drink were found for treatment, or for the interaction of treatment by sociopathy. A similar result was found in the analysis of time to first heavy drinking day, with a main effect for sociopathy (risk ratio=1.029, $p<.05$), as also noted above in the outpatient arm. Again, no effects on time to first heavy drinking day were found for treatment or for the interaction of treatment with sociopathy.

With respect to the APD client attribute, no significant effects were found in analyses of time to first drink or time to first heavy drinking day.

Causal Chain Analyses

The reader is reminded that the aftercare coefficients associated with the CPI–So client attribute are the ones below the path arrows in the causal chain figures introduced in the outpatient section.

CBT Versus MET Contrast. In the aftercare arm, working alliance was not related to CPI–So (path coefficients=−0.11 and −0.14, figure 4). Working alliance was related to the DDD outcome for MET clients (path coefficient= −0.14) as expected (greater working alliance associated with fewer DDD). As in the outpatient arm, working alliance was also related to both outcomes for CBT clients, contrary to our expectation that the relationship would only occur for MET clients.

With respect to the anger causal chain (figure 5), treatment differences had no impact on change in anger at either level of sociopathy. However, change in anger did have the expected impact on outcome among high sociopathy clients: decreased anger was associated with improved PDA and DDD outcomes (path coefficients=0.21 and −0.34, respectively). For aftercare clients, this effect occurred only among those with high sociopathy, as anticipated.

There were no differences in ratings of therapy structure (figure 6) between CBT and MET (path coefficients=0.18 and −0.01). The relationships between therapy structure and outcome were opposite to what had been predicted: greater structure was related to lower PDA (path coefficients=−0.35 and −0.20) and to more DDD among high sociopathy clients (path coefficient=0.20).

TSF Versus MET Contrast. The pattern of results for this contrast (figure 7) was largely similar to that for the CBT versus MET contrast, with therapy structure as the mediating variable. There were no differences in ratings of therapy structure between aftercare TSF and MET (path coefficients=0.12 and −0.01). A similar deviation from the predicted relationship between therapy structure and PDA outcome was observed here as in CBT versus MET: greater structure was related to fewer PDA at both levels of sociopathy (path coefficients=−0.57 and −0.23). However, in this case, greater structure was also related to a decline in DDD among high sociopathy clients (path coefficient=−0.61), a strong finding in the predicted direction despite the opposite-direction finding for the PDA outcome.

TSF Versus CBT Contrast. Client sociopathy was not related to AA attendance (path coefficients=−0.04 and 0.00, figure 8). Nevertheless, AA attendance was strongly related to outcome, more so for TSF clients than for CBT clients, as in the outpatient arm.

Change in anger was not related to type of treatment (TSF or CBT) nor to either of the outcome variables (data not shown).

Aftercare Arm—Discussion

Prognostic Effects of Sociopathy/APD

In the aftercare arm, there were no main effects of sociopathy or APD on either of the primary outcome variables (PDA or DDD). However, the anticipated effect of sociopathy/APD was found among the time-to-event measures: clients with higher ratings of CPI sociopathy relapsed more quickly to both a first drink and to a first day of heavy drinking than did clients with low sociopathy ratings.

Treatment Matching Effects

The lone significant matching effect for either the sociopathy or APD client variables (across both arms of the trial) was an APD by treatment by time effect in which APD-positive aftercare clients who were exposed to the CBT intervention had fewer DDD than clients who had been treated in TSF. This effect was in the predicted direction, but it dissipated over time. The effect was found only for DDD early in the posttreatment period but was not found for the PDA outcome nor with the sociopathy matching variable. Little weight can be given to an isolated finding that was statistically significant for only the first 2 months posttreatment. This stands in contrast to the finding of Cooney et al. (1991), also in an aftercare sample, that sociopathic

clients treated in CBT had superior outcomes for 18 months following treatment.

Causal Chain Analyses

Working Alliance. Sociopathy was unrelated to working alliance in either CBT or MET. Nevertheless, working alliance was positively related to both drinking outcomes among CBT clients (contrary to initial expectations) but only to DDD among MET clients. The working alliance causal chain broke down because of the lack of a differential relationship between sociopathy and working alliance (it had been hypothesized that there would be a negative relationship between sociopathy and working alliance) and because the relationship of working alliance to outcome for CBT clients was more pronounced than for MET clients.

Anger. Change in anger was unrelated to the CBT or MET treatments for either high or low sociopathy clients. Nevertheless, reduction in anger was associated with improvements in both PDA and DDD among high sociopathy clients, as anticipated, and was unrelated to drinking outcomes of low sociopathy clients, also as anticipated. The anger causal chain broke down because CBT was no more effective in reducing anger than MET.

Structure. The causal chain broke down in both links: in the inability of either CBT or TSF to demonstrate greater structure than MET and in the prediction that greater structure would be related to better drinking outcomes, especially for high sociopathy clients. In fact, greater structure of therapy was associated with *worse* PDA outcomes for both high and low sociopathy clients in all three treatments. The lone relationship in the predicted direction was that greater structure was strongly associated with fewer DDD in high sociopathy clients, although the corresponding PDA value was significant in the direction opposite to what had been predicted. The reasons for this inconsistency, or for the opposite-direction effects, are not understood.

AA Attendance. The anticipated relationship between sociopathy and AA attendance did not materialize: sociopaths were no less likely to get involved in AA than nonsociopaths. Thus the causal chain expectation that sociopathy would differentially affect the probability of AA attendance was not supported. However, degree of client involvement in AA was related to positive drinking outcomes across all three treatments.

Summary for Aftercare Arm. Sociopathy was not associated with hypothesized mediators such as working alliance, change in anger, or AA attendance. Furthermore, none of the treatments was rated as more structured than the others. Thus, the first link was not confirmed for any of the proposed causal chains.

As for the second link, working alliance, anger reduction, and AA involvement were all generally related to better drinking outcomes as hypothesized, but the predicted differential effects for high versus low sociopathy clients did not materialize. Therapy structure, on the other hand, was negatively rather than positively related to drinking outcome (greater structure was associated with worse PDA outcome, regardless of sociopathy level).

Overall Summary

Neither sociopathy nor APD had clear, consistent effects on outcomes, not directly nor in interaction with any of the three treatments. Although a few effects were found, they were isolated findings that were not consistent across the two outcome variables, the two arms of the trial, or characterizations of the client attribute (sociopathy versus APD). Of six hypothesized matching effects (three contrasts each for the sociopathy and APD client attributes), only one attribute by treatment by time effect was found. The only light the causal chains shed on this situation is that the anticipated differential effects of high versus low sociopathy upon the proposed mediating variables did not materialize. Thus, the basic reasoning underlying the a priori matching hypotheses did not receive empirical support. This was the case despite the fact that the hypothesized mediating variables did generally have at least some of the anticipated relationships with outcome: better working alliance, anger reduction, and AA involvement were for the most part associated with better drinking outcomes.

The failure to find support for the first link of the causal chains may to some extent explain the failure to obtain the hypothesized matching

effects. However, it is also possible that the operationalizations of the mediating variables were inadequate or that we failed to identify the proper mediating variables.

One prior study did find treatment matching based on client sociopathy in an aftercare setting (Kadden et al. 1989; Cooney et al. 1991), and another found matching based on diagnosis of APD among outpatients (Longabaugh et al. 1994). The causal chains in the present study provide few clues as to why we failed to replicate the matching effects that were previously reported with the same client variables. Since neither of the earlier studies included tests of causal chains, there is little basis for understanding the substantial differences between the outcomes of those studies and the current one.

Various speculations can be offered as to why the present results do not confirm those prior independent studies. The Kadden et al./Cooney et al. study employed group therapy, with heterogeneous groups of clients. In the CBT groups of that study, it is possible that the therapists may have adjusted the intervention to accommodate the needs of the lowest functioning members of each group, while largely ignoring the higher functioning clients, who as a result may have found the groups boring and unhelpful. A similar process may have also occurred in the "relationship enhanced" therapy employed by Longabaugh et al., in which the focus of treatment may have shifted somewhat from the alcoholic member of the dyad due to the presence of the significant other and therefore may have been less helpful in meeting the needs of APD alcoholics. In the individual therapy of the present study, the therapists could give their full attention to the particular needs of each client, so that the higher functioning clients may have had their needs met better and therefore benefited as much from the CBT intervention as the lower functioning clients and more than the higher functioning clients in the two earlier studies. For similar reasons, the sociopathic and APD clients who were assigned to TSF and MET may have benefited from the individual attention they received in them, thus minimizing the differences between those therapies and CBT.

Neither Project MATCH nor the other studies cited included measures of coping skills acquisition. Possibly some of the anomalous findings with respect to client-treatment matching with CBT might have been explained if the target of the CBT intervention, enhancement of coping skills, had been directly assessed. Similarly for the other treatments, relevant target behaviors or mediating variables may not have been identified or adequately measured.

A final issue to consider is the comparison between sociopathy and APD as alternative ways of characterizing clients for matching purposes. Kadden et al. (1989) found treatment matching based on sociopathy (CPI–So scores) but not based on the presence/absence of an APD diagnosis. Longabaugh et al. (1994), however, did find matching to APD diagnostic status. No conclusion can be drawn from the present data regarding the relative effectiveness of these two means of characterizing clients due to the lack of significant matching findings with either one of them.

As a result of this study, the status of sociopathy and APD as client matching variables is uncertain. They received support in prior studies but not in the present one. A number of differences between the earlier studies and the present one have been discussed, but it will remain for future research to settle the matter.

Acknowledgments

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Alcoholic Typology as an Attribute for Matching Clients to Treatment

Mark D. Litt, Ph.D., and Thomas F. Babor, Ph.D.

ABSTRACT

The typology of alcoholic clients developed by Babor and associates (1992) that defines the Type A/Type B distinction was evaluated as a basis for matching clients to treatment in Project MATCH. It was hypothesized that the more severe Type B alcoholics would have better outcomes if treated in Cognitive-Behavioral Coping Skills Therapy or Twelve Step Facilitation as opposed to Motivational Enhancement Therapy (MET), and that the less severe Type A alcoholics would fare better with MET. Hierarchical linear model analyses using monthly percentage of days abstinent and drinks per drinking day for the 12 months following treatment as the dependent variables revealed that Type B clients had fewer abstinent days over the followup period, as predicted. However, the analyses failed to show any other effects on outcome attributable to client type, or to any interaction of client type with treatment, in either arm of the study. Furthermore, client type was not predictive of outcome in the outpatient arm at the 3-year posttreatment followup point, nor was type predictive of time to first slip or time to resumption of heavy drinking. Results are discussed in the context of general outcomes found in Project MATCH, and the utility of the alcoholic typology is evaluated.

Alcoholism appears to be a multiply determined entity, with biological, psychological, and social factors all interacting to produce a drinking problem (e.g., Tarter 1983). Recognition of the diverse nature of the alcoholic population has led to a search for homogeneous subtypes or groups of alcoholics that share similar characteristics. If such groups could be identified, it might be possible to devise treatments that would accommodate their specific needs and thereby maximize treatment effectiveness. This is the logic behind the creation of alcoholic typologies.

A number of typologies have been proposed to discriminate different subgroups of alcoholics (e.g., Cloninger 1987; Jellinek 1960; Morey and Skinner 1986). Few of these, however, have been replicated in new samples, and fewer still have demonstrated external validity by showing that different subtypes have better outcomes with different types of treatments (Brown et al. 1994).

In view of the multidimensional nature of alcoholic drinking, it has been suggested that a clinically meaningful and predictive typology would encompass multiple domains, including clinical course, genetic predisposition, drinking behavior, psychosocial functioning, and comorbid psychopathology. One such typology was developed by Babor and colleagues (1992), who used k-means cluster analysis with a heterogeneous sample of 321 alcoholics. The clustering solution identified two "types" of alcoholics who differed consistently across 17 defining characteristics in both the male and female samples. The first, termed "Type B alcoholics," is characterized by a family history of alcoholism,

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premorbid childhood conduct problems, early onset of problem drinking, rapid progression of drinking problems, more psychiatric disturbance, greater alcoholism symptom severity, and poor prognosis. The second group, called "Type A alcoholics", is characterized by later onset of drinking, fewer indicators of vulnerability, less psychiatric disturbance, a more benign alcohol-related problem profile, and better prognosis.

The results of the clustering analyses were consistent with historical and contemporary typological theories that have postulated similar subgroups of alcoholics, such as those described in Cloninger's neurobiological learning model (1987). Other findings from the Babor et al. (1992) study and elsewhere suggested that an empirically derived multidimensional typology of alcoholism could have theoretical implications for explaining the heterogeneity among alcoholics and might provide a useful basis for treatment matching.

Prognostic Significance

There is evidence that Type A alcoholics differ from Type B alcoholics both in their overall prognosis and in their responses to different treatments. In their initial study of 321 male and female treated alcoholics, Babor et al. (1992) found that Type B alcoholics had significantly worse treatment outcomes than those classified as Type A at 12- and 36-month followups, as measured by total number of drinking days during followup and drinks per drinking day. Additionally, in a 3-year outcome study by Yoshino and Kato (1996), 259 Japanese alcoholics were classified as Type A or Type B in a similar manner. Type A alcoholics had lower mortality and higher abstinence rates than did the Type B alcoholics by the end of the followup period.

Prior Matching Effects

A study by Litt and associates (1992) indicated that client type was not only prognostic of outcome but might also be useful in matching clients to treatment. In this study, the two-group typology was replicated on a sample in which alcoholic clients had been randomly assigned to one of two different kinds of group aftercare treatment. The data used in this study were originally collected by Kadden and colleagues (1989) to evaluate the treatment-matching implications of three theoretically based client dimensions: sociopathy, psychopathology, and neuropsychological status. Because the Kadden et al. (1989) study was designed to measure client characteristics in a way similar to the Babor et al. (1992) study of alcoholic subtypes, it provided an ideal opportunity to replicate the Type A–Type B distinction and to test the treatment-matching hypothesis with the cluster-derived typology.

Analyses of proportion of heavy drinking days immediately following aftercare treatment and at several subsequent followup points indicated that, consistent with the Babor et al. (1992) findings, Type A alcoholics fared better overall than Type B clients at the followup points (main effect for type: $F(1, 43)=4.96$, $p<.05$). Additionally, however, a significant client type by treatment interaction was found ($F(1, 41)=4.10$, $p<.05$). Type A clients fared best in interactional treatment and more poorly with coping skills training, whereas those clients classified as Type B alcoholics by the clustering procedure had better outcomes with the coping skills treatment and worse outcomes with interactional therapy. Differences in treatment response were maintained for 2 years from the beginning of aftercare treatment.

The results suggested treatment-matching effects wherein Type A clients were best matched to interactional group therapy and Type B clients were best matched to coping skills therapy. Effects sizes for matches versus mismatches were substantial: at the end of the 2-year followup, for example, 45 percent of matched clients were still abstinent compared with only 15 percent of mismatched clients. The authors speculated that the structured cognitive-behavioral treatment was well-suited to Type B clients, who may have benefited from the clear goals and procedures. The relationship-focused interactional therapy, on the other hand, was thought better suited to the Type A clients, who were less in need of basic skills than in receiving the motivation from others to use the skills they already had. The coping skills treatment was thus thought to be less relevant for the Type A clients in this study.

The Litt et al. (1992) study provided a convincing demonstration of the potential for using client type as a matching variable. Although the MATCH treatments were all delivered on an individual basis, there were significant similarities with the group treatments described in Litt et al. (1992) and Kadden et al. (1989). Motivational Enhancement Therapy (MET; Miller et al. 1992) in Project MATCH, for example, like the interactional group therapy in Kadden et al. (1989), was not considered to be a highly structured, intense treatment, but was expected to be more interpersonally centered, relying for its effectiveness on the ability of the therapist to quickly establish trust and rapport.

The MATCH Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992) condition, on the other hand, was very much like the coping skills treatment in Kadden et al. (1989), with its emphasis on skills and problem-solving and its highly structured approach. Given the outward similarities in treatments, it was expected that Project MATCH clients would respond like the clients described in the Litt et al. (1992) study.

Based on our previous typological research and the results of the Litt et al. (1992) matching study, we proposed the following hypotheses (figure 1):

- *There would be an overall main effect for client types, with high severity (Type B) clients relapsing sooner, drinking more frequently, and experiencing more drinking-related problems than low severity (Type A) alcoholics in all treatment conditions.*
- *Type B alcoholics would fare best in the CBT and Twelve Step Facilitation (TSF; Nowinski et al. 1992) treatments, and poorly in MET. Type A alcoholics would respond well to MET and relatively less well in TSF and CBT.*

Rationale for the Matching Hypothesis

The matching findings of the Litt et al. (1992) study suggested that several important "active ingredients" of the treatments have differential importance for Type A and Type B alcoholics. We speculated that these active ingredients included structure of treatment and change in cognitions, change in psychopathology, and various therapist relationship factors.

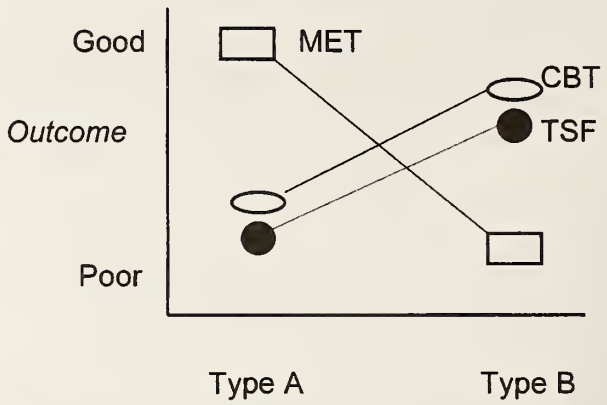

Figure 1. Hypothesized outcomes in Project MATCH as a function of treatment assignment and alcoholic type.

Structure

We believed that Type B clients would be more likely to benefit from the highly structured, programmatic CBT and TSF treatments, in which performance and role expectations are clearly defined, than from the less structured, more open-ended form that MET takes. This prediction was based on evidence indicating that clients who are more severely impaired in terms of general psychopathology do poorly in traditional psychotherapy (Sloane et al. 1975), possibly because of a reduced ability to learn in unstructured treatment sessions (Truax and Carkhuff 1967).

Additionally, a similar differential success prediction would result from considering the client's sociopathy. The Type A/Type B typology is influenced by the level of sociopathy as well as other vulnerability factors that affect both alcohol dependence and ability to control impulsiveness or regulate behavior. Type B clients show higher levels of sociopathy and other indicators of poor impulse control (e.g., conduct disorders) that may inhibit learning and skill acquisition in therapy situations that are not highly structured. Walker (1992), for instance, writes that substance abusers with antisocial personality have little awareness of their own thoughts and

feelings and how they influence their behavior. Treatment for these individuals should be kept simple, with a firm structure and the clinician clearly directing the process of therapy. The CBT approach in Project MATCH should have been ideally suited to these clients.

Nace (1989), in his discussion of substance abuse treatment for those with antisocial personality, also stresses the importance of firm structure in therapy, with the setting of clear limits and a constant focus on abstinence. In their lack of impulse control and need for abstinence the Type B clients resemble the classic gamma alcoholic (Jellinek 1960). These attributes make Type B clients good candidates for a 12-step approach (an approach designed originally for just such a population; Nowinski et al. 1992) as well as the CBT treatment. Conversely, it was felt that Type A clients would feel unduly constrained by the highly structured CBT and TSF treatments and would prefer the more open-ended, less predictable MET approach.

Cognitive Change

It was expected that the structure and demands for behavior change inherent in the CBT and TSF treatments would be differentially useful for the Type B individuals and that treatment gains would be mediated by cognitive changes resulting from treatment. The treatment demands were expected to lead to behavior change that would result in increases in self-efficacy and motivation. Bandura (1977) has stated that the most influential source of self-efficacy is actual performance. By attending regular and frequent treatment sessions and stopping drinking, self-efficacy should be increased. It was believed further that the CBT and TSF treatments, by virtue of their clear demands for change, would increase motivation for change, leading the person to movement from a precontemplation or contemplation stage of change to an action stage.

Type A individuals, on the other hand, were not expected to benefit from the directiveness of CBT and TSF. It was believed that these persons would already be sufficiently motivated and that their self-efficacy would be enhanced by following through with their own plans for change.

Change in Psychopathology

In addition to other signs of impairment, Type B clients are more likely to score higher on indices of psychopathology such as depression and anxiety. Work by Rounsaville and others (e.g., Rounsaville et al. 1987) has indicated that those higher in psychopathology are likely to have poorer outcomes in treatment. Because of the explicit focus on psychopathology in CBT, it was expected that Type B clients would experience relief of psychiatric symptoms and thus have better outcomes in this therapy. Additionally, because the MET treatment was so brief and had little content related to psychopathology, it was believed that Type B clients would derive less benefit in this treatment. Although TSF had no specific content focus on psychopathology, the frequent visits and support from AA were expected to help relieve psychopathology symptoms and thus predict better treatment outcomes for Type B clients.

Relationship Factors

It was thought that Type B clients, who are more likely to show sociopathic characteristics, would have more difficulty relating to the therapist and making use of the therapy process (Garfield 1978) than would Type A clients. Type A clients, on the other hand, being relatively unimpaired, would be able to make appropriate use of the therapist relationship in MET and might be put off by the lack of such a relationship in CBT, which was considered to be a less relationship-oriented therapy.

A variety of relationship issues having to do with the nature of the CBT and MET therapists could play a role in the outcomes of the various treatments. The MET therapists were trained to be persuasive as well as accepting and empathic in order to quickly establish the rapport required to help motivate clients. CBT and TSF therapists, on the other hand, were trained to be active, challenging, and confrontational. Type B clients, it was thought, would benefit from the clear directions for lifestyle change and the unwillingness of the CBT and TSF therapists to allow the Type B client to avoid making behavioral changes. Minimally impaired Type A clients, however, might feel cornered or attacked

by a confrontational therapist and would prefer an approach that allowed them greater autonomy.

Causal Chain

To summarize, the factors presented above were expected to give rise to changes in certain measurable constructs that would have a bearing on outcome. The causal chain was as follows:

For Type B clients, CBT and TSF treatments, with their greater intensity and structure and their emphases on straightforward behavior change, would be well-suited to Type B clients' learning style.

The skills focus in both treatments, presented in a highly structured and easily coherent manner by a therapist who makes performance expectations clear, would lead to increased cognitive shifts for change, reflected in greater motivation (stage of change), and greater self-efficacy.

Furthermore, practice of these skills in homework assignments (in CBT) should help increase clients' self-efficacy, making it more likely they would practice the skills they learned and thus lead to better outcomes.

Finally, as Type B clients learned and practiced more skills and showed greater motivation to change, support relationships would improve and psychopathology would decrease (e.g., clients would become less depressed and anxious about relationships, work, etc.).

MET, by contrast, with its relatively unstructured focus on motivation would not deliver specific instruction in skills to stop drinking and would be less useful to Type B clients.

For Type A clients in MET, adaptive changes in cognitions were expected to occur, but in a different way from Type B individuals. Because Type A clients were relatively high functioning, it was expected that they would benefit from the low intensity of the therapy by receiving confirmation of their own plans to change (reflected in slight movement in stage of change, as from *contemplation* to *action*). Self-efficacy for change would also increase as a result. Social supports should also improve as treatment efforts at change were made. No changes would be expected in measures of psychopathology.

Hypothesized Matching Contrasts

Consistent with the theoretical rationale, it was concluded that the most obvious treatment contrasts would be those between CBT and MET, and TSF and MET. Given the similarities between CBT and TSF in terms of intensity, structure of therapy, and relationship factors, it was determined that, for Type A and Type B clients, the CBT and 12-step treatments would be almost equivalent. Because of this, these two treatments were combined in analyses such that the contrast of interest was that between MET clients and those in *either* CBT or TSF.

Operationalization of the Matching Variable

Assigning Clients

The original typology formulation was based on 17 defining characteristics that tapped 4 conceptual domains: vulnerability factors, alcohol involvement, chronicity of alcohol problems, and comorbid psychopathology. In the MATCH data set, we identified 14 variables that measured each of the different domains of the typology, and first sought to replicate the two-group typology using k-means cluster analysis. Results of the cluster analyses replicated those of the Babor et al. (1992) and Litt et al. (1992) studies. The most coherent solution was a two-cluster solution that classed individuals as Type A or Type B.

Although the two-group Type A/Type B classification was clearly replicated with the Project MATCH variables using cluster analysis, it was thought that a more practical test of the typology-matching hypothesis would entail classifying people by means of simple a priori classification rules rather than by means of algorithms derived from a cluster analysis of the entire study sample. We therefore developed a quick classification decision-rule using a smaller number of variables with data obtained from a segregated sample of the first 40 clients enrolled at each Clinical Research Unit.

Based on previous work with three different alcoholic samples (Babor et al. 1992; Brown et

al. 1994; and Litt et al. 1992), evidence suggested that a reasonably good classification could be made on the basis of five variables, each measuring one of the following domains: familial risk, personality vulnerability, dependence severity, consequences of drinking, and psychopathology. These variables were considered to be the best representatives of the domains in the typology, and they could be measured reliably:

- Family history of alcoholism (tapping risk; median number of first-degree relatives positive for alcohol abuse = 0.33)
- MacAndrew Alcoholism scale score (MacAndrew 1965), as a measure of vulnerability (median score = 27.0)
- Ethanol Dependence Syndrome Scale score (Babor 1996; median score = 35.0)
- Physical consequences of drinking index (Babor et al. 1992; median score = 17)
- Antisocial personality symptom count from the Computerized Diagnostic Interview Schedule for DSM–III–R (Robins et al. 1981; median count = 3.0 symptoms).

The typology assignment (the type variable) was made according to a criterion rule, namely, that a person should be high on some minimum number of variables to be considered Type B (severe). Anyone who scored above the median on three of the five variables was classed as Type B.

Characteristics of the Variable

Once chosen, the 5 variables were tested against the complete 14-variable typology using data from the segregated sample. The 5-variable typology assignment corresponded very well with the cluster analysis-derived 14-variable typology assignment, with a sensitivity of 0.93, a specificity of 0.79, and overall efficiency of 0.84.

The distribution of the type variable was examined in the complete data set (N=1726). The ratio of 54 percent Type A to 46 percent Type B was exactly what we expected for the complete data set. When the sample was divided by arm of study, Type As outnumbered Type Bs in the outpatient arm by 586 to 360 (62 to 38 percent), but in the aftercare arm, the Type Bs outnumbered Type As 435 to 332 (57 to 43 percent). As for distribution by sex, men were nearly evenly distributed between Types A and B, but Type A women outnumbered Type B women by almost 3 to 2 (63 to 37 percent). These distributions were consistent with previous research (Brown et al. 1994).

Finally, the correlations of the type variable with the other primary matching variables was assessed in the complete data set. The strongest association was with Alcohol Involvement (r= 0.51), followed by sociopathy (r=0.41). Correlations with the other variables were relatively modest. These analyses indicated that the two-group typology is a robust classification scheme, replicated in several samples, and that the five-variable classification algorithm provides a good approximation of the more complex clustering of Type A and Type B individuals.

Results

The primary tests of the matching hypotheses for each arm of the study were conducted using hierarchical linear modeling (HLM) analyses. Separate analyses were performed for the period during which treatment was taking place (from intake to end of treatment, months 1–3), and for the period from end of treatment to the end of the 1-year followup (months 4–15). The primary dependent variables (DVs) in these analyses were (a) percentage of days abstinent (PDA; arcsin transformed to correct for nonnormal distributions) and (b) drinks per drinking day (DDD; square-root transformed). These DVs were measured weekly during the 1–3 month period, and monthly during the 4–15 month period. Details regarding these analyses can be found in Longabaugh and Wirtz's chapter (pp. 4–17) of this monograph.

The covariate set used for these analyses included the pretreatment value of the drinking DV. Although controlling for pretreatment drinking could partially nullify differences between client types, this covarying was done to make sure that any differences in outcome would be attributable to the longstanding, dispositional aspects of client type and not to recent drinking history.

A family-wise type-1 error rate of 0.05, specified beforehand for each matching attribute, was further divided by 2 to account for the two

dependent variables. Because only one contrast of interest (CBT and TSF versus MET) was specified for the client type attribute, effects had to reach a Bonferroni-corrected significance level of $p<.025$ (i.e., 0.05/2) to be considered meaningful.

Outpatient Arm

1–3 Month Period

HLM analyses performed for the period during treatment revealed no significant effects attributable to client type, either alone or in interaction with treatment assignment or time. These results were the same for both dependent variables.

4–15 Month Period

With PDA as the dependent variable, a significant main effect for typology was found ($F(1, 952)=5.93$; $p<.025$), with Type B clients having a greater percentage of drinking days during this posttreatment period than did Type A clients. No effects significant at the Bonferroni-corrected level were seen for any interaction of type with treatment site, with time, or with treatment assignment. With DDD as the dependent variable, no significant effects were seen.

3-Year Followup

For outpatient clients only, followup data were collected at the 3-year posttreatment point and covered study months 37, 38, and 39. Drinking data from these 3 months were averaged to provide one value for each of the dependent variables, PDA and DDD, at 3 years. For neither of the dependent variables was client type, or the interaction of client type with treatment assignment, significant at the Bonferroni-corrected level of 0.025.

Aftercare Arm

1–3 Month Period

When PDA was used as the DV, no significant effects were seen for any of the terms involving client type. The same results were seen when DDD was the DV.

4–15 Month Period

In the aftercare arm, with PDA as the dependent variable, no significant effects were seen for client type or for any interaction of client type with treatment or with time. The same absence of effects was seen when the dependent variable was DDD. In brief, client type was found to be neither a prognostic variable nor an attribute that could be used for matching purposes when outcome was measured out to 15 months.

Secondary Outcome Variables: Time to Event Measures

In addition to the primary outcome measures (PDA and DDD), three time to event measures were used in the evaluation of typology as a matching variable. The three measures were time to first drink, time to first heavy drinking day, and time to first period of three consecutive heavy drinking days. All times to events were measured from the beginning of treatment. Time was measured in days, and the data were obtained from the Form 90 (Miller 1996) timeline followback measure. A heavy drinking day was a day in which six or more drinks were consumed for men, or four or more drinks were consumed for women. Analyses were conducted using Cox proportional hazards modeling, with baseline drinking (both baseline PDA and baseline DDD), treatment site, treatment type, and site by treatment, as covariates and the interaction of treatment (CBT clients plus TSF clients combined versus MET clients) with client type entered as the last term in the model.

Results of the analyses indicated that client type was not predictive of any time to event outcome, either alone or in interaction with treatment type. This was true in both study arms.

Testing the Causal Chains

The matching hypotheses discussed above postulated more or less complex mediating steps, or causal chains, that would account for differential treatment outcomes for the two types of client. By examining these causal chains, we attempted to discover where our hypotheses failed and thus find out why client type

appeared to have so little influence on the outcome of clients in project MATCH.

The A Priori Causal Chain

Causal chains were analyzed using structural equation modeling. The two primary outcome variables, PDA and DDD, which were measured at 12 time points (i.e., study months 4 through 15), were modeled as latent growth curves as suggested by McArdle (McArdle 1986; McArdle and Epstein 1987). That is, for each of the two dependent variables, a single latent variable was created, made up of the measures taken at each of the 12 followup points. Since the model uses repeated-measures data, the latent factors are interpreted as chronometric (time-based) factors representing individual differences over time (McArdle 1986). In these factors, the dependent variable at each time point makes an independent weighted contribution to the latent outcome variable. Thus, the latent variable takes into account the changes for each individual at each time point.

Results

Three primary causal chain hypotheses were tested. The first hypothesis was that both CBT and TSF treatments would be more structured than MET but that only the Type B clients would benefit from this additional structure in terms of cognitive changes from pretreatment to posttreatment that would lead to improved outcomes. Thus, only Type B clients were expected to show a positive relationship between therapy structure and cognitive change. For Type A, we predicted a nonsignificant or even negative relationship between perceived therapy structure and cognitive change. This is the hypothesis represented in simplified form in figure 2.

The results of this first analysis are shown in figure 3. Therapy structure was determined by rating videotapes of therapy sessions, using a rating scheme developed by Carroll et al. (1998). Cognitive change, in the figure, is a latent variable made up of the pre-to-post change scores on the Alcohol Abstinence Self-Efficacy Scale (DiClemente et al. 1994) and the University of Rhode Island Change Assessment (DiClemente

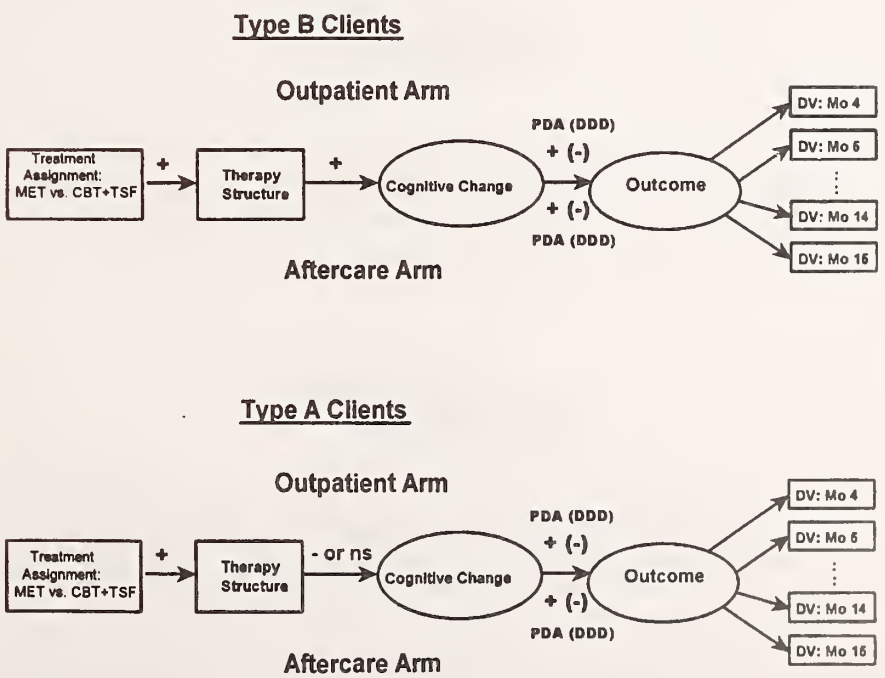

Figure 2. Hypothesized causal chain explaining expected client-treatment matching effect. In figures to follow, results for the outpatient arm are represented above the arrows and results for the aftercare arm are represented below the arrows. Outcome in these analyses is modeled as latent growth curves comprising the repeated DVs (month 4 DV through month 15 DV).

and Hughes 1990), a measure of motivation. In the figure, both dependent variables and both arms of the study are represented. The path coefficients that appear over the arrows in the diagram show the results for the outpatient arm. Coefficients for the aftercare arm are shown below the arrows. The coefficients to the left indicate results when PDA was the outcome; coefficients in parentheses indicate results when the outcome was DDD. The coefficients are interpreted as beta weights. Asterisks indicate that the coefficients are significant at the $p<.05$ level. Coefficients above 0.25 are considered to indicate strong prediction.

Positive cognitive change (i.e., increase in self-efficacy and motivation for change) was strongly related to outcome (positively related to PDA and negatively related to DDD), except for Type B clients in the outpatient arm. Ratings of therapy structure, however, were only weakly related to treatment received, and rated structure was virtually unrelated to cognitive change. The weak relationships explain the poor fit of the models to the data; model chi squares were highly significant, and the goodness-of-fit indices averaged about 0.75.

The second hypothesis was that Type B clients would score higher on measures of psychopathology and that they would experience significant decreases in psychopathology (decreases in Addiction Severity Index (ASI) Psychiatric subscale scores) in the CBT and 12-step treatments versus MET, but that Type A clients would not. Analysis of variance confirmed that Type B clients did in fact have higher baseline ASI Psychiatric scores than did Type A clients ($F(1, 1699)=25.84$, $p<.001$). The decrease in psychopathology was expected to be related to improved outcome. Results of these analyses are depicted in figure 4. (Change in psychopathology was calculated such that positive change indicated a decrease in severity and thus should be positively related to PDA and negatively related to DDD).

In this case, none of the hypothesized relationships held. Change (decrease) in psychopathology was virtually unrelated to outcome, regardless of dependent variable used or arm of

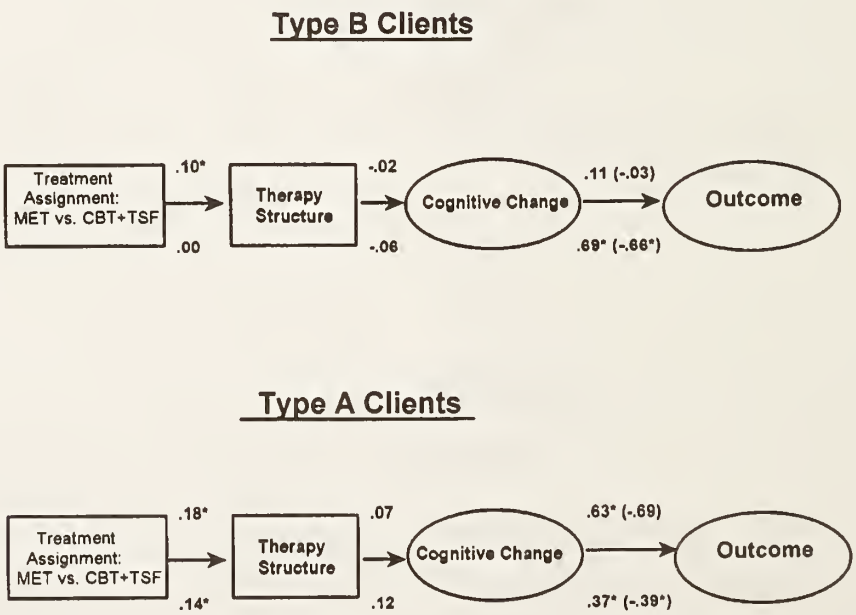

Figure 3. Results of structural equations analyses of expected causal chains. Coefficients above the arrows are those for outpatient clients; the coefficients below the arrows refer to aftercare clients. Coefficients to the left refer to outcome expressed in PDA; coefficients in parentheses to the right refer to outcome expressed as DDD. Under Treatment Assignment, MET was coded as 0 and CBT+TSF was coded as 1. Asterisks indicate that the magnitude of the coefficient was significantly different from 0 (by t-test) at the $p<.05$ level.

study, except for a small effect for Type A clients in the outpatient arm. Additionally, treatment assignment apparently made no difference with respect to change in psychopathology. Again, the models shown were poor fits to the data, with highly significant model chi-square values and goodness-of-fit values averaging 0.75.

The last hypothesis was that in Type A clients there would be a positive relationship between treatment and working alliance, as measured by the Working Alliance Inventory (WAI; Horvath and Greenberg 1986), in that Type A individuals in MET would show greater WAI scores than in CBT+TSF. Working alliance was at best only weakly related to outcome, regardless of client type, study arm, or dependent variable (figure 5). Additionally, the hypothesized differential effects of client type and treatment assignment on clients' evaluations of working alliance failed to appear. Model chi-square values were once again highly significant, and goodness-of-fit statistics averaged only 0.80, indicating relatively poor fit of the models to the data.

Discussion

Client type is intended to describe more than just a client attribute. It is a multidimensional construct that encompasses biological and psychological vulnerability, drinking history, and likely prognosis. As such, it should have been an ideal matching variable—one would be hard pressed to think of two kinds of people who are more different or who should respond more differentially to treatment. Yet not only did client type not prove to be a useful matching variable in the present study, with the exception of predicting PDA in the 4–15 month period in the outpatient arm, it did not even turn out to be prognostic. These results are contrary to our own previous results indicating that client type can be a matching variable (Litt et al. 1992) as well as a number of studies showing that client type can be highly prognostic (e.g., Gibbs and Hollister 1993; Shanks et al. 1995; Yates et al. 1993). The purpose of the present study was to explore which of our assumptions may have been in error.

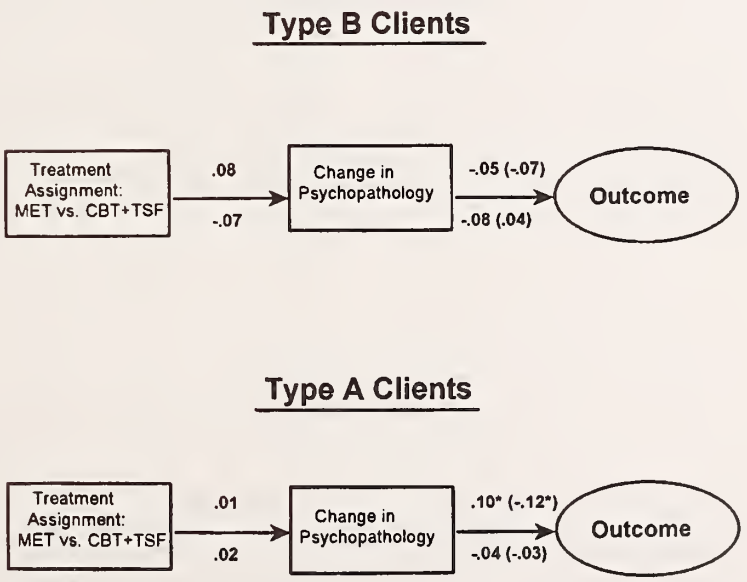

Figure 4. Results of structural equations analyses of causal chain examining psychopathology change as a mediating variable. Coefficients above the arrows are those for outpatient clients; the coefficients below the arrows refer to aftercare clients. Coefficients to the left refer to outcome expressed in PDA; coefficients in parentheses to the right refer to outcome expressed as DDD. Under Treatment Assignment, MET was coded as 0 and CBT+TSF was coded as 1. Asterisks indicate that the magnitude of the coefficient was significantly different from 0 (by *t*-test) at the $p < .05$ level.

Our hypotheses in this study were based upon results found in previous work. Type B clients, whose drinking history, consequences, and psychopathology were so much worse than those of Type A clients, were expected to fare more poorly than Type A individuals regardless of treatment. This occurred in only one arm (outpatient) on one dependent variable (PDA), and the effect vanished when other matching variables were included in the analyses (see Project MATCH Research Group 1997*a*). The fact that Type B clients did not do more poorly may be a clue as to what occurred in Project MATCH.

One possible reason that client type accounted for so little variance in outcome is that there was relatively little variance in outcome to start with, at least in terms of the two primary dependent measures, PDA and DDD. As has been described elsewhere (Project MATCH Research Group 1997*a*), drinking in all treatment conditions dropped dramatically from pretreatment to posttreatment. It is possible that a floor effect in outcome may have made the discovery of main effects for most client attributes almost impossible. If this were true, then no attribute by treatment interactions would be likely to be found either. This was largely the case in Project MATCH; only three attributes, psychiatric severity, trait anger, and alcohol dependence, showed attribute by treatment interactions that were not time-dependent (Project MATCH Research Group 1997*a*,*b*).

If lack of variance were responsible for the lack of effect attributable to client type, then most other variables and constructs would also fail to predict outcome. This, too, was the case in Project MATCH and showed up in both primary outcome measures and in time to event measures. In the structural equation models in the present chapter, only cognitive change, defined as increases in self-efficacy and motivation, predicted drinking outcomes.

Another possible reason why client type failed to account for treatment outcome, or play a role as a matching variable, is that our

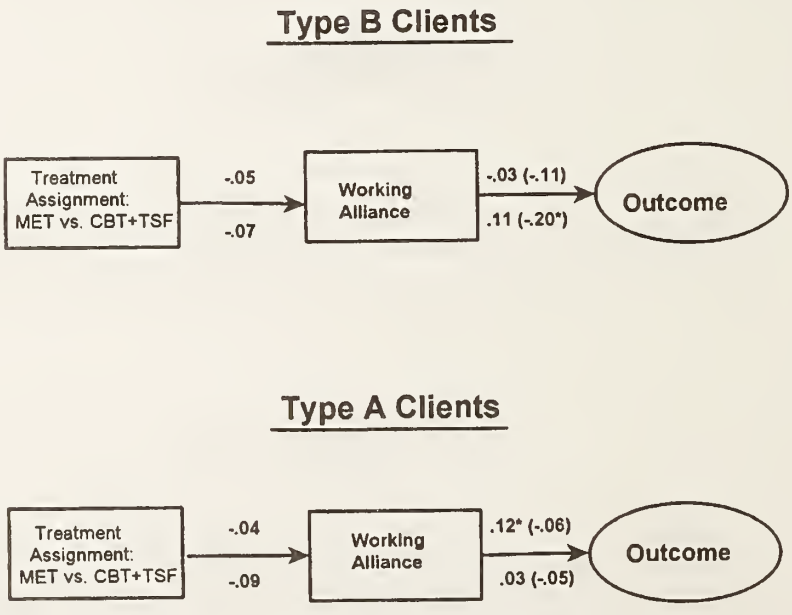

Figure 5. Results of structural equations analyses of causal chain examining working alliance as a mediating variable. Coefficients above the arrows are those for outpatient clients; the coefficients below the arrows refer to aftercare clients. Coefficients to the left refer to outcome expressed in PDA; coefficients in parentheses to the right refer to outcome expressed as DDD. Under Treatment Assignment, MET was coded as 0 and CBT+TSF was coded as 1. Asterisks indicate that the magnitude of the coefficient was significantly different from 0 (by *t*-test) at the $p < .05$ level.

assumptions were wrong about what occurs in therapy, or even about the importance of specific aspects of therapy. The structural equations models suggest that clients did not respond to treatment in the ways we expected. Despite distinct differences in how the treatments were designed and implemented (Carroll et al. 1998), these differences apparently were not reflected in client perceptions. MET, for example, was not perceived by clients as entailing increased working alliance relative to CBT and TSF, and CBT and TSF did not result in improvements in psychopathology relative to MET. Independent raters did, for the most part, perceive TSF and CBT as being more structured than MET, but this effect was neither strong nor ultimately very important to outcome. In summary, the findings suggest that whatever occurred in Project MATCH served generally to increase clients' motivation and self-efficacy and that these changes were not associated with specific characteristics of the treatments.

An additional explanation for the failure of client type to predict outcome or to interact with treatment may be because the two types, although different on numerous dimensions, were nevertheless equivalent on some other attributes that may have been more important. An examination of the means on a variety of variables indicated that, as intended, the two types were substantially differentiated from one another on indicators of vulnerability, severity of dependence, and sociopathy and psychopathology. Differences on means between the two client types on these variables ranged from one to two standard deviations. But on two other variables, the results were quite different. On baseline readiness for change, an important prognostic variable in Project MATCH, Type B clients actually scored higher than Type A clients. And the two types were equivalent on another predictive variable, social support for drinking. Thus, the two types of clients may have been indistinguishable on some of the most significant attributes of the trial. Because neither readiness nor social support for drinking were measured in the earlier studies of client typology, it is not clear whether the Type B clients in those studies were fundamentally different from those in Project MATCH.

A final explanation for the differences between results found in Project MATCH and those found in earlier studies may have to do with an interaction between the Project MATCH clients and the way that treatment was delivered. In the Litt et al. (1992) report, for example, clients were treated in group therapies, and no concessions could be made for the special needs of individual group members. In Project MATCH, the clients were treated individually. Motivated clients, even if they were Type B clients, may have been able to extract from their therapists whatever it was they needed to change, regardless of therapy type, possibly including straightforward recommendations for change from MET therapists. (This might help explain why there were no apparent differences in rated structure between treatments for Type B clients.)

Given the results of Project MATCH, one question that now presents itself is whether alcoholic typology is worthwhile as an explanatory or clinical construct. The answer to that question should be considered in the context of Project MATCH itself. To the extent that Project MATCH represented an artificial treatment situation, with closely supervised individual treatment, frequent paid followups, and the participation and cooperation of significant others, then the validity of all potential client attributes was compromised. It might be argued that studies that have found prognostic, and even matching, effects for client type were somewhat better representatives of the actual state of substance abuse treatment than was Project MATCH. Bearing in mind the results from other studies, and the possible lack of generalizability of results from Project MATCH, the alcoholic typology remains an appealing construct. What Project MATCH does indicate, however, is that regardless of drinking severity and vulnerability, significant improvements in outcome are possible under the right circumstances. Even the most severe alcoholics can go far toward recovery.

Acknowledgments

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Part IV: Personality Variables

Client Anger as a Predictor of Differential Response to Treatment

Prospects for Matching Clients to Alcoholism Treatments Based on Conceptual Level

The Search for Meaning in Life as a Predictor of Alcoholism Treatment Outcome

Religiosity and Responsiveness to Alcoholism Treatments

The Interpersonal Dependency Matching Hypothesis

The Gender Matching Hypothesis

Client Anger as a Predictor of Differential Response to Treatment

Holly Barrett Waldron, Ph.D., William R. Miller, Ph.D., and J. Scott Tonigan, Ph.D.

ABSTRACT

This client-treatment matching study examined the a priori matching hypothesis for a differential effect of client anger on treatment outcome for three treatments for clients with alcohol abuse or dependence: Motivational Enhancement Therapy (MET), Cognitive-Behavioral Coping Skills Therapy (CBT), and Twelve Step Facilitation (TSF). The findings provide strong support for the matching hypothesis. For outpatient clients higher in pretreatment anger, MET was associated with significantly more abstinence and less intense drinking, compared to CBT and TSF. These results indicate a distinct advantage in assigning angry outpatients to MET. Also, clients low in anger fared better in CBT and TSF than in MET, reflected in the disordinal rather than ordinal matching interaction. Results of analyses examining why the matching effect occurred were less clear. Process variables expected to underlie the differential effectiveness (attendance, treatment satisfaction, and therapeutic alliance) did not mediate the observed interaction. However, there was support for resistance as an important variable within the matching effect. Implications for the matching findings, the different pattern of findings for outpatients and aftercare clients, and future directions for pursuing the causal chain associated with the matching effects are discussed.

Anger is a basic negative human emotion defined as an internal, subjective feeling state with associated negative cognitions and physiological arousal patterns, the experience of which can vary in intensity and fluctuate over time in response to the environment (Spielberger et al. 1983; DiGiuseppe et al. 1994). Anger is differentiated from other emotions through a labeling process based on perceived stimulus conditions that evoke the emotion and/or on the inclinations to act which are associated with the emotion (Berkowitz 1990). Labeling an emotion as anger may occur when interference with goals, a physical or psychological threat, or an intentional misdeed are perceived, or when expectations or attitudes are incongruent with the environment. An emotion that gives rise to motivation to respond to these perceptions (e.g., defend the self, change the environment, prevent mistreatment, or seek revenge on others) may also be labeled as anger (Edmondson and Conger 1996).

Anger can be conceptualized as having two components: (1) the general tendency or disposition (trait) of the individual toward anger that remains relatively stable across situations and (2) the feeling state of anger that fluctuates as a function of situational factors in the environment and the individual's tendency toward anger (Spielberger 1988).

The concept of hostility, often used interchangeably with anger, is quite similar to Spielberger's notion of trait anger. Hostility has

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been defined as a personality trait characterized by the chronic display of angry affect and aggressive behaviors (DiGiuseppe et al. 1994). Thus, hostility reflects a combination of angry emotion and action. The rationale for the present matching hypothesis integrates theoretical and empirical literatures investigating anger and/or hostility, combining trait and state conceptions.

Rationale for Matching Hypothesis

Anger is common in ongoing interpersonal relationships (Averill 1982). Research has revealed a broad spectrum of negative concomitants of anger and of hostility, including impaired cognitive functioning (Laird et al. 1982; Jaderlund and Waldron 1994), ill health (Barefoot et al. 1983; Diamond 1982; Smith et al. 1990), verbal or physical aggression (Maiuro et al. 1988; Margolin et al. 1988), impaired peer relationships among children (Dodge et al. 1986), and disturbed marital and family relationships (Gottman and Krokoff 1989; Patterson 1985). Moreover, hostility has been shown to preclude productive problem-solving and communication skills training and lead to poorer therapy outcome (Alexander et al. 1989; Barton et al. 1985; O'Donnell and Worrell 1973).

Clients entering treatment frequently present with anger problems (Deffenbacher et al. 1994). According to DiGiuseppe and his colleagues (1994), angry clients generally do not seek treatment for help in changing their angry response into a healthier one; instead, they are often motivated to try to change the target of their anger rather than themselves. They tend to view their anger as justified, not deviant. Moreover, angry clients often deny that their anger is a problem and may be more resistant to treatment, rendering them more difficult to treat.

The therapeutic alliance can also be compromised by client anger. The success of the therapeutic alliance depends on the formulation of a bond based on warmth, acceptance, and trust between therapist and client and on their agreement on tasks and goals of therapy (Bordin 1976). A therapist's attempts to change a client's anger may be perceived by the client as the therapist's disbelief that the client was wronged or that some transgressor was responsible for the problem (Walen et al. 1992). As a result, angry clients may have more difficulty forming a therapeutic bond and are less likely to reach agreement on goals of therapy than clients with other emotional problems. Angry clients may also be especially prone to responding defensively during therapy when exposed to direction or confrontation, therapist behaviors that have been shown to increase client resistance (Miller et al. 1993; Patterson and Forgatch 1985).

Resistance in Therapy

Client resistance has traditionally been considered a theoretically important process variable in the psychotherapy literature. The concept of resistance is one of the cornerstones of psychoanalytic theory, which holds that "working through" clients' reluctance to give up their symptoms is central to the process of change (Wolberg 1967). In the behavior therapy literature, resistance is often framed as client noncompliance, with therapists responsible for ensuring compliance in their prescription of therapeutic tasks (Hersen 1971).

Family theorists have viewed resistance as inherent in the change process because families attempt to maintain homeostasis in their relationship functioning (Aponte and VanDeusen 1981) or as the therapist's failure to attend adequately to cognitive or interpersonal relationship factors before implementing a behavior change plan (Alexander and Parsons 1982; Waldron and Slesnick 1998). In general, resistance has been attributed to a variety of sources, including factors that reside within individual clients (including anger), the product of an interpersonal interaction between therapist and client, the contribution of external environmental factors such as court-mandated treatment, limited efficacy of therapeutic practices, or a lack of therapist skill (Anderson and Stewart 1983; Lazarus and Fay 1982; Robin and Foster 1989).

Overt anger, argumentativeness, and oppositionality have been suggested as ways in which resistance can be manifested in therapy

(Anderson and Stewart 1983; Newman 1994), although actual research making this connection has been rare. However, Chamberlain and her colleagues (1984) provide some support for the notion that pretherapy levels of anger may influence client resistance in therapy. These investigators found higher levels of resistance in agency-referred clients versus self-referred clients, and this resistance was associated with poorer treatment outcome. Possibly, clients who are referred for treatment by an agency (e.g., through the court system) are more defensive about their problems and respond to treatment with more resistant behaviors, such as denial of responsibility and projection of blame onto others.

Clients vary considerably in their presenting levels of resistance to therapy (Brehm 1972; Hersen 1971; Anderson and Stewart 1983). Client resistance, in turn, has been shown to be predictive of premature termination (Chamberlain et al. 1984; Kolb et al. 1985) and poorer treatment outcomes (Burns and Nolen-Hoeksema 1991; Kolb et al. 1985; Miller et al. 1993; Orlinsky et al. 1994) across treatment models and client populations. In the areas of addictive behaviors, lack of compliance and failure to persist in treatment are particularly problematic (Clancy 1961; Dicicco et al. 1978). For example, Miller et al. (1993) showed that problem drinkers who were more resistant during treatment, as evidenced by inattention, silence, changing the subject, or other negative responses such as denying responsibility for drinking, had higher levels of alcohol consumption a year after therapy had ended.

Therapist Behaviors and Treatment Outcome

A number of therapist behaviors have also been shown to influence therapy outcome. For example, therapist supportiveness and empathic style have been related to client improvement in therapy (Orlinsky and Howard 1986), whereas therapist confrontation and defensive style have been related to less favorable outcomes (Alexander et al. 1976; Beutler et al. 1984; Waldron et al. 1997). In general, these same therapist behaviors have been associated with client resistance during treatment. For example, positive therapist attributes and behaviors such as warmth, support, and reframing appear to be related to more cooperative responding in therapy (Alexander et al. 1976; Barbera and Waldron 1994; Patterson and Forgatch 1985; Robbins et al. 1996). Patterson and Forgatch (1985) also found that teaching and confronting (i.e., directive) behaviors were related to increased client resistance in the second session of family therapy.

The same pattern of findings has been shown in research on alcohol treatment. Among problem drinkers, empathic therapist style has been associated with favorable long-term treatment outcomes (Miller and Baca 1983; Miller et al. 1980; Valle 1981). Conversely, Milmoe and associates (1967) found that therapists' hostile vocal tone predicted reduced treatment effectiveness for alcoholics, and Miller et al. (1993) found that a directive-confrontational style yielded significantly more resistance from clients, which in turn predicted poorer long-term outcome.

Motivational Enhancement Therapy (MET)

As a treatment approach, MET specifically targets client resistance and has as its primary goal the mobilization of clients' commitment to change (Miller and Rollnick 1991; Miller et al. 1992). A variety of strategies are prescribed to defuse and decrease resistant client behavior, including avoiding argumentation, expressing empathy, and providing the client with choices in therapy. Other strategies are applied to evoke clients' own self-motivational statements of problem recognition, concern, need for change, and self-efficacy. Self-efficacy is viewed as essential to the process of change. According to Miller and Rollnick (1991), a client who perceives a threat or problem but does not believe that change is possible, will likely become defensive and turn toward denial or resistance instead of behavior change.

This emphasis on creating and eliciting motivation for change distinguishes MET from the other approaches examined by Project MATCH: Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992) and Twelve Step

Facilitation (TSF; Nowinski et al. 1992). The proposed anger hypothesis provides a unique challenge for MET. If MET is a successful approach for increasing motivation, then clients who are more resistant to treatment, by virtue of their higher levels of anger, should fare better in this treatment specifically formulated to de-escalate resistance than in treatments which do not have this specific emphasis.

The Hypothesized Matching Contrast

A single between-group hypothesis was proposed with regard to the interaction of client anger with treatment modalities in influencing outcomes. Expressed in relation to the dependent variable of total alcohol consumption, the hypothesis was that *clients high in anger will show significantly greater reduction in alcohol consumption when treated by MET than by either CBT or TSF. No difference between treatments was expected for clients low in anger.*

This predicted interaction was expected because MET is designed specifically to reduce client resistance and enhance motivation, whereas both CBT and TSF are more directive and action-oriented methods. The matching effect was expected to occur via a causal chain including the following steps:

- Angry clients have poorer treatment outcomes because they tend to be resistant to change.
- MET is designed to diffuse resistance, while CBT and TSF are more action focused.
- High anger clients should therefore fare better when assigned to MET relative to assignment to CBT and TSF.

Noteworthy, the causal model does not propose any changes in client anger associated with treatment assignment. High anger clients may remain so even when assigned to the MET therapy. The important point is that MET is intended to focus upon the resistance of angry clients not on their anger per se.

Operationalization of the Matching Variable

The State-Trait Anger Expression Scale (STAX) was used to measure client anger. This 44-item instrument was designed to measure angry emotion as a situational response (state) and as a disposition (trait) of an individual (Spielberger 1988). The STAX is composed of eight subscales (State-Anger, Trait-Anger, Trait-Temperament, Trait-Reaction, Anger-In, Anger-Out, Anger-Control, and Anger-Expression) as well a total anger score which was used to define the matching variable in this study. Spielberger (1988) reported subscale coefficient alphas ranging from 0.84 to 0.93, indicating adequate internal consistency of the measure. Studies examining the validity of the STAX scales have also supported the psychometric strength of the instrument (cf. Spielberger 1988). The total anger score was used as the continuous matching variable in this study.

Alcohol Consumption

Drinking outcomes were assessed by the two primary dependent variables selected for Project MATCH (1993, 1997*a*): percentage of days abstinent (PDA) during each followup interval and the average number of drinks per drinking day (DDD, with abstainers coded as zero). Research interviews were completed at 3, 6, 9, 12, and 15 months after intake and (at seven outpatient sites) at 39 months as well. Over 90 percent of cases were interviewed for each followup interval.

Causal Chain Variables

The logic of the causal model was straightforward: angry clients tend to have poorer outcomes because they are resistant to change. MET diffuses this negative aspect of client resistance while CBT and TSF exacerbate resistance because of their action focus. Central to testing the causal model was the development of a measure reflecting client resistance. No a priori measure was included in the Project MATCH baseline assessment battery to measure resistance to change. Several measures,

however, were included to assess client motivation for change (e.g., SOCRATES; Miller and Tonigan 1996). Logically, two SOCRATES subscales—Recognition of problem and Taking Steps toward change—represent the *antithesis* of client resistance. In the absence of a more direct measure of resistance, we selected these two subscales as reverse proxies for client resistance (e.g., anger and problem recognition should be negatively correlated at baseline).

Results

Complete intake data needed for computation of the anger score were provided by 94 percent (n=896) of the outpatient and 95 percent (n=734) of the aftercare samples. On average, aftercare clients reported significantly higher anger (M=30.81, SD=7.63) than did outpatient clients (M=29.46, SD=7.25), $t(1,628)=3.68$, $p<.0002$, but the absolute difference in mean values (about one item) was not considered clinically meaningful. No mean differences in baseline anger were found among the three randomly assigned outpatient treatment conditions, $F(2, 893)=1.71$, $p<.18$. Female outpatient clients reported somewhat higher anger than did their male counterparts, $t(894)=2.03$, $p<.04$. In the aftercare sample, no mean differences in baseline anger were found among treatment conditions, $F(2, 731)=0.42$, $p<.66$, or between genders, $t(732)=1.04$, $p<.30$.

Finally, and in both outpatient and aftercare samples, baseline anger was significantly ($p<.001$) and positively related with other client matching variables discussed in this monograph, including overall psychiatric severity (outpatient r=0.31, aftercare r=0.24), meaning-seeking (outpatient r=0.43, aftercare r=0.40), alcohol dependence (outpatient r=0.26, aftercare r=0.23), antisocial personality disorder (outpatient r=0.26, aftercare r=0.23), sociopathy (outpatient r=0.37, aftercare r=0.40), and motivation for change (SOCRATES; outpatient r=0.15, aftercare r=0.16).

Outpatient Sample

Prognostic Effects of Anger

The main effect of client anger on posttreatment drinking was examined using several analytical techniques. Zero-order and second-order partial correlations were computed to show the extent of association between anger and proximal posttreatment drinking (months 4–9), not taking into account variation in posttreatment drinking attributable to site and treatment conditions. The prognostic effects of client anger were also examined in the context of hierarchical linear modeling (HLM) in which site, treatment, and linear and quadratic time main effects as well as their product terms with each other and with anger were included in the omnibus model.

Contrary to prediction, clients' anger level measured at intake was not related to frequency (r=-0.01, $p<.84$) or intensity r=0.01, $p<.71$) of drinking during the first 6 months after treatment. Controlling for intensity and frequency of drinking at intake, second-order partial correlations also reflected no significant relationship of anger to drinking during followup. In the HLM context, no prognostic effect of anger was found using monthly values of frequency ($p<.75$) and intensity ($p<.89$) of drinking during posttreatment months 4–12. Post hoc analysis indicated that anger and PDA were weakly and negatively related in two sites (r=-0.10 and -0.11) and virtually unrelated in the three remaining sites (r=0.08, 0.04, and 0.02).

Tests of the Anger Matching Hypothesis

The a priori hypothesis stated that clients higher in anger at intake would fare better (higher PDA and fewer DDD) during posttreatment when assigned to MET relative to similar clients assigned to the combined CBT and TSF conditions. The analytic strategy for testing of the a priori hypotheses has been described in detail elsewhere and will only be briefly outlined here (Project MATCH 1993, 1997*a*, *b*; Longabaugh and Wirtz, this volume, pp. 4–17).

HLM was used to test the secondary matching hypothesis, and three statistical tests were conducted to evaluate the parallelism of the two slopes representing the relationship between anger and a primary outcome measure by the specified treatment contrast, here MET versus CBT and TSF combined.

One of these tests examined whether the two slopes were parallel and, if not, if nonparallelism was in the predicted direction. Importantly, this test collapsed the *12 months of followup* and can be interpreted as an omnibus test of whether the predicted match was present for the *entire* 12 months of followup. The second and third statistical tests evaluated whether a finding of nonparallelism varied across the 12 months of followup in a linear or quadratic fashion, and rejection of the null hypothesis for these tests led to post hoc monthly contrasts to identify the months in which the predicted match was manifest.

For exploratory purposes, this same analytical strategy was used to examine potential client anger matching during the 12 weeks of treatment. The only difference between the posttreatment and within-treatment analyses was that the former used monthly drinking values and the latter used weekly PDA and DDD values. Finally, a 3-year followup was conducted for the outpatient sample, and matching findings have been reported elsewhere (Project MATCH Research Group 1998). A classical MANCOVA approach was used to test predicted matching hypotheses with the 3-month interval before the distal interview providing outcome data for the matching analyses in the outpatient sample. Time was not included in the model as a within-client factor.

Results of all prospective tests of the client-anger matching hypothesis are reported in table 1 under the column labeled, "Planned matching contrast." Columns to the right, labeled "Unplanned matching contrasts," show the pairwise

Table 1. State-trait secondary matching findings in the Project MATCH outpatient sample: Planned and unplanned matching contrasts (probability values)

	Planned matching contrast	Unplanned matching contrasts		
	[MET vs. CBT and TSF]	[MET vs. CBT]	[MET vs. TSF]	[CBT vs. TSF]
During treatment				
PDA	.11	.06	.39	.26
PDA (linear)	.23	.42	.20	.65
PDA (quadratic)	.12	.29	.10	.58
DDD	.31	.39	.36	.97
DDD (linear)	.25	.59	.14	.37
DDD (quadratic)	.51	.63	.50	.87
Twelve months posttreatment				
PDA	**.01**	**.02**	.12	.44
PDA (linear)	.69	.65	.82	.81
PDA (quadratic)	.30	.83	.11	.16
DDD	**.01**	.06	**.03**	.85
DDD (linear)	.95	.72	.60	.88
DDD (quadratic)	.95	.81	.89	.70
Extended 39-month followup				
PDA	**.001**			
DDD	**.002**			

PDA = percentage of days abstinent
DDD = drinks per drinking day

treatment matching contrasts. These contrasts were not prospectively specified and are provided as exploratory analyses. The top portion of the table shows the probability values associated with the matching hypothesis tests during the within-treatment phase of the study. As shown, no support was found for client-anger matching during the 12 weeks of treatment in the outpatient sample.

Strong support was found for the client-anger matching hypothesis, however, for the 12 months *posttreatment*. Here, the omnibus HLM matching hypothesis was supported on both primary dependent measures (PDA $p<.014$ and DDD $p<.011$). Examination of figure 1 shows a disordinal interaction of anger with both PDA and DDD by the specified contrast. As predicted, and throughout the entire 12-month followup period, clients higher in initial anger had higher PDA and lower DDD when assigned to MET, relative to high anger clients assigned to CBT and TSF. In absolute magnitude, for clients at the highest decile of anger, a 9-percent difference in PDA was obtained between MET and the combined CBT/TSF groups, and 1.2 fewer drinks were consumed on drinking days

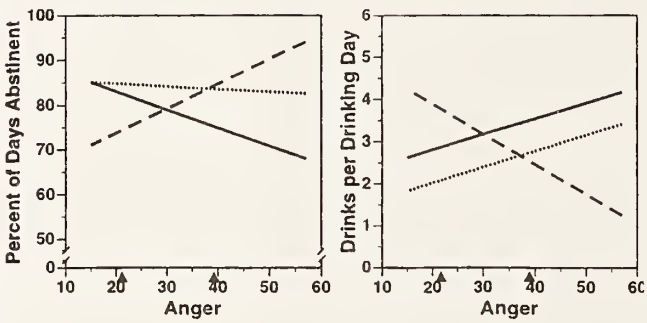

Figure 1. Posttreatment plot of percentage of days abstinent and drinks per drinking day showing the interaction between the three Project MATCH treatments and anger, in the outpatient arm. The vertical axes represent predicted outcome scores and the horizontal axes represent baseline anger, with higher scores indicating higher anger. The triangles on the horizontal axes indicate the 10th and 90th percentiles for anger in this study arm. Reprinted with permission from *Addiction*, Vol. 92, Issue 12, pp. 1671–1698, 1997. Copyright by Taylor & Francis Ltd., Oxfordshire, UK, http:/www.tandf.co.uk/journals. (–CBT; - -MET; ...TSF)

when assigned to MET. Not predicted, clients initially lower on anger had significantly fewer abstinent days relative to low anger clients assigned to CBT and TSF and also reported more intense drinking relative to low anger clients assigned to TSF.

Prospective statistical tests provided further strong support for the client-anger matching hypothesis at 3-year followup in the outpatient sample. Again, clients with higher baseline anger assigned to MET reported significantly more abstinent days ($p<.0005$) and drank significantly less intensely ($p<.0015$) than high anger clients assigned to CBT and TSF 3 years after the end of treatment. Not anticipated, but similar to findings in the 12 months immediately after treatment, the interaction was disordinal. Here, at 3 years after treatment ended, low-anger clients assigned to TSF and CBT reported higher PDA and fewer DDD than low-anger clients assigned to MET. Using raw data, the average PDA for the highest third of angry clients assigned to MET was 8.4 percentage points higher than for those assigned to CBT or TSF. Using this same procedure for the lowest third on the anger variable, low-anger clients assigned to CBT and TSF reported, on average, 14.4 percent more abstinent days than low-anger clients assigned to MET.

Causal Chain Analyses

We approached the analysis of our proposed causal mechanisms with enthusiasm. Only two a priori omnibus contrasts were supported by both primary dependent measures across months 4–15 in Project MATCH, and the anger hypothesis was the only such hypothesis supported for the entire 12 months after treatment *and* the extended 3-year followup.

The first step in our analysis was to assess the relationship between baseline client anger and resistance. Our model proposed a positive correlation between these constructs. Because our indicators of resistance were, in fact, antitheses of resistance (SOCRATES: Recognition of the problem and Taking Steps toward change), support for the first link of the causal chain would be evidenced with negative correlations between the two SOCRATES scales and client anger. One of the obtained correlations was

statistically significant but not in the predicted direction. Specifically, client baseline anger was positively and significantly related with Recognition (r=0.08, p<.02), and Taking Steps was unrelated with client anger (r=0.03, p<.46).

Inconsistent findings using the two SOCRATES scales led to the search for other variables reflecting client resistance to change. We turned to measures of the client-therapist working alliance (WAI; Horvath and Greenberg 1989) collected at the second week of treatment. This assessment was completed by clients after the second therapy session and inquired about the extent to which clients perceived (1) a bond with the assigned therapist, (2) agreement with treatment goals, and (3) agreement with therapeutic tasks.

Bivariate correlations with these measures partially supported our prediction that angrier clients would be more resistant to treatment. For example, client anger and agreement with therapeutic goals were significantly and negatively related (r=-0.10, p<.008), anger and bonding were unrelated r=-0.04, p<.26), and anger and task agreement tended to covary negatively (r=-0.05, p<.18). We concluded that the first assumption of our model was, at best, partially supported. Clearly, the relationship between client anger and resistance was more complex than we originally conceived, perhaps compounded by our relatively crude proxies of client resistance.

Reduction of resistance in MET was the critical proposed mediating process in our causal model explaining the obtained matching effect. Hierarchical multiple regression analyses (MRA) were therefore conducted to partial out both the main effect of resistance and the resistance by treatment interaction from the single degree of freedom (df) client anger matching test. Substantial support for the proposed causal model would be obtained if inclusion of these two resistance terms in the model eliminated the observed matching effect.

Also included in the model were baseline values of the dependent measure, site, treatment, and anger main effects as well as all first-, second-, and third-order product terms. These analyses used the drinking data for the 12 months posttreatment and, because the obtained matching effect was not time dependent, we collapsed the 12 monthly values of drinking (PDA and DDD) into single time point outcome measures. Further, because of the complexities in operationalizing resistance, we repeated these analyses five times for each dependent measure (PDA and DDD), using separately each of the five proxy measures of client resistance.

Results of these 10 MRA runs are reported in table 2. As shown, when the dependent measure was PDA, the incremental effect of the single df anger matching contrast was no longer significant after controlling for any one of the five resistance terms. These findings suggest that treatment outcome was mediated in the a priori client anger hypothesis by client resistance—measured five different ways. Less support for the mediational role of client resistance was found using the drinking intensity measure as the dependent variable. Here, only Taking Steps appeared to mediate the treatment outcome, and the remaining four measures of resistance did not appear to mediate treatment outcome in the context of the specified treatment contrast.

Aftercare Sample

Prognostic Effects of Anger

No significant relationship was obtained between baseline anger and frequency (r=0.06, p<.13) or intensity (r=-0.05, p<.19) of drinking during the 6 months after treatment. Even smaller relationships were found using second-order correlations controlling for frequency and intensity of drinking for the 90 days before treatment (largest obtained r=-0.04, p<.27). Controlling for site, time, and treatment main effects and their interactions, HLM analyses also indicated that anger did not predict frequency (p<.34) or intensity (p<.23) of drinking for aftercare clients during the 12 months after treatment. Unlike the outpatient sample, examination of the replicability of relationships across aftercare sites indicated relative stability of findings and, hence, substantial confidence can be placed in the lack of prognostic importance of anger in predicting posttreatment drinking.

Table 2. Significance of client-anger matching hypothesis tests (PDA and DDD) after separately partialing out five measures of client resistance: Outpatient sample 12 months posttreatment (probability values)

Resistance measure	PDA[1]	Mediators	DDD[2]	Mediators
Recognition of the problem	0.06	**0.001**	**0.04**	**0.014**
Taking Steps to make changes	0.24	**0.001**	0.18	**0.001**
WAI:				
Therapeutic Bond	0.09	0.118	**0.04**	0.297
Goal Agreement	0.06	**0.006**	**0.02**	0.062
Task Agreement	0.08	**0.002**	**0.03**	0.058

[1] PDA—a summary measure of percentage of days abstinent calculated for the entire 12-month period

[2] DDD—a summary measure of drinks per drinking day calculated for the entire 12-month period

NOTE: Values in columns 1 and 3 after controlling for effects of the index of resistance; columns 2 and 4 computed before controlling for effects of the index of resistance.

Tests of the Anger Matching Hypothesis

The rationale of the client-anger hypothesis and the analytical strategy for testing the prediction were the same for the aftercare and outpatient samples. The aftercare sample did not have an extended 3-year followup, so prospective tests of the hypothesis could only be conducted separately for the 12 weeks of treatment and the 12 months after treatment.

Table 3 presents the results of the prospective HLM tests of the client-anger hypothesis for the aftercare sample. None of the planned matching contrasts supported the client-anger hypothesis (during or after treatment), whether as an omnibus test collapsing time or when time was modeled as a linear or quadratic function.

One concern about combining treatments was that predicted effects may occur in one of the two being combined, but the absence of the predicted effect in the second group may wash out an overall (combined) predicted effect. Examination of the unplanned matching contrasts in table 2 indicates that this concern was unwarranted for the client-anger hypothesis. None of the unplanned pairwise contrasts was significant either during the 12 weeks of treatment or during the 12 months posttreatment.

Causal Chain Analyses

Complete lack of support for the anger matching hypothesis in the aftercare sample led to an examination of where and how our prediction failed. The first step, of course, was to assess whether baseline client anger related with our measures of resistance to change. In this regard, we again used the two scales of the SOCRATES as reverse proxies of client resistance augmented with secondary measures of client resistance—the three scales of the WAI collected at the second week of therapy.

Bivariate correlations indicated that client anger was unrelated to the Taking Steps scale of the SOCRATES (r=0.03, p<.94) and significantly and positively related to Recognition (r=0.13, p<.001). Contrary to our predictions, therefore, angrier clients also tended to report higher Recognition (proxy for lower resistance). This finding is consistent with findings in the outpatient sample.

Unlike the outpatient sample, however, secondary measures of client resistance in therapy did not support our causal model. Specifically, baseline anger was unrelated with client report of therapeutic bond (r=−0.02, p<.72) and agreement of treatment goals (r=−0.05, p<.27) and tasks (r=−0.03, p<.52). Absence of a matching effect in the aftercare sample therefore seems most likely because of a breakdown in the initial rationale underlying the anger hypothesis.

Post Hoc Analyses

Although not specified in the anger matching hypothesis, a question of some import is how, if at all, client anger changed during the treatment phase of the trial. Equally important is the question of whether potential changes in client anger predicted posttreatment functioning.

Table 3. State-trait matching findings in the Project MATCH aftercare sample: Planned and unplanned matching contrasts (probability values)

	Planned matching contrast	Unplanned matching contrasts		
	[MET vs. CBT and TSF]	[MET vs. CBT]	[MET vs. TSF]	[CBT vs. TSF]
During treatment				
PDA	.26	.46	.23	.70
PDA (linear)	.91	.78	.93	.72
PDA (quadratic)	.59	.62	.66	.94
DDD	.40	.62	.34	.68
DDD (linear)	.93	.61	.71	.40
DDD (quadratic)	.56	.70	.54	.85
Twelve months posttreatment				
PDA	.18	.25	.67	.46
PDA (linear)	.46	.90	.77	.68
PDA (quadratic)	.23	.61	.43	.81
DDD	.38	.44	.77	.29
DDD (linear)	.13	.26	.40	.75
DDD (quadratic)	.09	.62	.06	.19

PDA = percentage of days abstinent
DDD = drinks per drinking day

Post hoc analyses were conducted to examine these questions in order to gain a better understanding of the anger matching variable used in Project MATCH.

Significant overall reductions in client anger were found between intake and end of treatment in both outpatient and aftercare samples (outpatient: $t(815)=-11.95$, $p<.001$; aftercare $t(632)=-8.56$, $p<.001$). Extent of pre-post change in client anger, however, was not differentially related to treatment group assignment in either the outpatient ($F(2, 813)=0.21$, $p<.81$) or the aftercare sample ($F(2, 632)=0.56$, $p<.57$).

Analyses reported earlier indicated that client baseline anger was not predictive of posttreatment drinking in either the outpatient or the aftercare sample. A related question is, were *changes* in client anger predictive of posttreatment drinking? To this end, bivariate correlations were computed between pre-post treatment change in client anger and 12-month summary measures of PDA and DDD. Treatment groups were collapsed because of the finding that change in anger was unrelated to treatment assignment. In the aftercare sample, anger reduction was unrelated to either drinking intensity ($r=0.00$, $p<.98$) or frequency of abstinent days ($r=-0.02$, $p<.62$) during the 12 months of followup. In contrast, in the outpatient sample, anger reduction was associated with significantly less drinking when drinking occurred ($r=-0.08$, $p<.02$), but not with frequency of abstinent days ($r=0.05$, $p<.19$). Changes in client anger during treatment were unrelated to 3-year drinking on both drinking measures.

Discussion

Strong support was found for the a priori matching hypothesis that drinking outcome would be differentially influenced by the

interaction of client anger and treatment modality. For outpatient clients higher in pretreatment anger, MET was associated with significantly more abstinence and less intense drinking, compared to CBT and TSF. These results indicate a clear advantage in assigning angry outpatients to MET.

Exactly *why* this matching effect occurred remains unclear. Process variables expected to underlie the differential effectiveness (attendance, treatment satisfaction, and therapeutic alliance) did not mediate the observed interaction. Nevertheless, there was support for the causal chain in that the observed matching effect disappeared when any one of five resistance proxies was entered as a covariate. This suggests that resistance was an important variable within the matching effect.

A key may lie in more complex analyses of therapy process to be obtained from detailed coding of session videotapes, where in-session resistance could be measured more precisely. Clients who behave in a hostile manner may, for example, typically elicit more negative responses from their therapists. Snyder and Swann (1978) have shown that hostile expectations generally elicit hostile behavior from interaction partners. In a psychotherapy setting, Pope and Tabachnick (1993) found that therapists experience feelings such as anger with their clients and these feelings may be translated into angry behaviors during therapy. These would be expected to result in an escalation of client resistance, which is associated with poorer client outcomes. Indeed, Miller et al. (1993) found that it was not the presence of positive "motivated" client speech, but the relative *absence* of client resistance that predicted more positive outcomes in MET, and showed that client resistance was under the experimental control of therapist style (cf. Patterson and Forgatch 1985).

It may be that such angry reciprocation by therapists to hostile clients is suppressed by training in MET. Peterson and colleagues (1997) conducted a sequential analysis of therapist and client behaviors during the various phases of MET sessions in Project MATCH. Only MET processes and outcomes were examined, and no comparisons were made with other therapy approaches. We were interested, among other things, in studying client behaviors that followed therapist confrontation responses, expecting to see an increase in resistance. It is noteworthy, in reference to current findings, that not a single "angry" or confrontational response was found in videotapes from 22 different MET therapists participating in the trial. This suggests that MET therapists were indeed not reciprocating clients' negative behaviors, which could account for better outcomes for angry clients in the MET condition. A full testing of this relationship will require more extensive examination of videotapes from all three treatment conditions.

Alternatively, angry clients may be more reactive to therapists' attempts to structure their behavior. In accord with the theory of reactance, Brehm (1972) maintained that clients will behave in ways that preserve their personal freedom, even if doing so is countertherapeutic. Traditional behavioral treatment models characterize the therapist role as a teacher or guide. Cognitive-behavioral coping skills interventions targeting client anger typically specify the content and sequencing of therapist techniques to be presented to clients. Providing choices to clients and leading clients to draw therapeutically sound conclusions on their own (e.g., through Socratic methods) may be more effective (Newman 1994). In one study, Deffenbacher et al. (1994) suggested that a more inductive, client-focused approach to skills training in which strategies for anger management are elicited from the clients and not imposed on them would be more effective in lowering resistance and improving outcome. They found that the inductive application of skills training was significantly more effective than standard skills training approaches in reducing daily anger. MET specifically emphasizes personal freedom of choice and prescribes strategies that elicit self-directing responses from client.

In the MET model, motivation and resistance are viewed as products of the interaction between client and therapist (Miller 1983). Similarly, Kiesler (1982) argued that the therapeutic relationship derives from reciprocal exchanges between therapists and clients. According to Kiesler, the evoking style (e.g., anger) that some

clients bring to therapy and the manner in which therapists respond to them likely reflects an important aspect of the therapeutic relationship. Examining therapy interactions in microanalytic detail, then, may provide a more fruitful strategy for understanding the dynamic relationship that develops between angry clients seeking treatment for alcohol problems and MET therapists, offering clues to how that relationship influences treatment outcome. Well-developed microanalytic therapy coding systems (e.g., Chamberlain et al. 1986; Pinsof, 1980) could be used to compare the patterns of therapist behaviors and cooperative and resistant responses of clients across the three treatment conditions. Such an examination may illuminate the actual causal chain underlying the matching results found in this study.

Also worthy of further attention is the unanticipated finding that clients low in anger fared better in CBT and TSF than in MET, reflected in the disordinal rather than ordinal matching interaction. One possibility is a mismatch of MET (originally designed for clients less ready for change) with clients who are less angry and resistant and are already more motivated for change. Such clients may be ready for and prefer the more structured change strategies of CBT or TSF.

Functional family therapy (FFT), which is one therapeutic model used to treat families with drug and alcohol problems, integrates both motivational and behavior change strategies in dealing with substance use problems in families (Alexander and Parsons 1982). The impact of FFT depends in part on the specific techniques prescribed, but perhaps even more so on the particular sequencing or timing of the techniques across sessions, with readiness for change as the focus of earlier sessions and behavior change strategies implemented in later sessions, after motivational and assessment tasks have been completed. According to the model, attempting to institute behavioral changes with unmotivated families will evoke resistance, but with enhanced motivation, families can move more quickly into the behavior change phase (Waldron and Slesnick 1998). Motivational interviewing has been used effectively as an add-on component to other treatment models (Bien et al. 1993; Brown and Miller 1993). Combining MET with other, more structured approaches for clients with alcohol problems, taking into account client anger and readiness for structured interventions, might allow therapists to tailor the treatment to clients' stage of readiness and provide for the most optimal treatment match.

Also unexplained is the strong matching effect among outpatients, but no matching effect among aftercare clients. Both received outpatient treatment in Project MATCH, the difference being that aftercare clients had recently completed a week or more of inpatient or day hospital treatment. The causal chain analyses reported above did not reveal significant process differences that would account for a matching effect in only one arm of the study. Microanalyses of session videotapes again may prove more revealing.

Finally, it should be noted that client anger was measured in a somewhat limited way for present analyses. Using the STAX, we were able to find support for differential treatment outcomes, but a more comprehensive measure including other aspects of anger such as indices separating frequency, intensity, and appropriateness of angry feelings may provide additional information in understanding and addressing anger in treatment and in helping to elucidate the specific aspects of an anger-prone person's anger experiences. A more refined behavioral measure might produce clearer findings. Certainly, client resistance behaviors coded from therapy sessions have proved useful in predicting treatment outcomes (e.g., Miller et al. 1993).

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Prospects for Matching Clients to Alcoholism Treatments Based on Conceptual Level

John P. Allen, Ph.D.

ABSTRACT

Conceptual level refers to a broad experiential style of relating to one's environment. Individuals low in the dimension tend to think in rather concrete ways and often conceptualize issues as dichotomous rather than as complex and multidimensional. Previous research has suggested that alcoholics low in conceptual level tend to do better with more structured interventions. In Project MATCH, it was hypothesized that lower conceptual level patients would derive greater reduction in frequency and intensity of drinking if assigned to Twelve Step Facilitation and that higher conceptual level subjects would fare better with Motivational Enhancement Therapy. This matching hypothesis was not confirmed, but, to at least some extent, this may have been due to very poor reliability in the measure of conceptual level chosen.

Conceptual level (CL) refers to a consistent, pervasive cognitive and motivational style of relating to one's environment. CL is measured as a continuous variable ranging from cognitive simplicity (i.e., a proclivity to view situations and issues as concrete "black-white" dichotomies) to cognitive complexity (i.e., a sensitivity to subtle nuances and a tendency to abstract about situations and see issues from multiple perspectives).

Individuals low in CL are believed to learn and function most effectively in an environment which structures their experiences for them. High CL individuals, however, are assumed to do best in a nondirective, unstructured environment which allows them maximal freedom to make decisions for themselves. Conversely, low CL individuals would be predicted to be confused and threatened in environments stressing self-direction and judgment.

Two lines of research suggest that matching based on congruence of CL of clients with certain aspects of treatment may improve outcome. Most relevant is McLachlan's (1972) work dealing specifically with alcoholics. General research on psychotherapy and educational interventions also suggests that CL relates to choice of interventions differing in degree of structure.

Previous Research

McLachlan (1972) studied 92 alcoholic inpatients at the Donwood Institute in Toronto, Canada. The sample appears to have been reasonably high in social stability as reflected by the fact that most were currently married, the mean educational level was 12.7 years, and they were being treated in a private facility. While

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information on severity of dependence was not reported, only about one-third had received prior treatment for an addiction problem. Clients with "known" brain damage and those with severe physical or emotional problems such as to render them inappropriate for group therapy were excluded from the study.

Prior to initiation of therapy, clients were administered the Paragraph Completion Method (PCM; Hunt et al. 1978) and a verbal intelligence measure. Five group therapists also completed the PCM. Interrater reliability of the clients' CL thus measured was 0.93 with an internal consistency coefficient of 0.82. (Reliabilities for staff members' CL were not reported.) Fifty-three clients were classified as low CL (i.e., PCM score <1.5). Using higher cut points, two therapists were classified as low CL and three as high CL. Nurses in consort also ranked therapists on nondirectiveness in treatment. A Spearman's rho of 0.90 was reported between degree of nondirectiveness and CL for therapists.

The treatment program is briefly summarized in the report as 26 hours of group psychotherapy conducted over 3 weeks. The overall intervention strategy was identified as reconstructive, client-centered, and involving frequent use of psychodrama. The stated goals of therapy were to help clients cope with problems contributing to their dependency on alcohol, to enhance self-confidence, and to improve interpersonal skills.

Outcome measures on eight therapy rating scales were obtained from clients. The group therapist and group nurse also rated each client on overall improvement by using a 6-point ordinal scale from "worsened" to "complete alleviation of presenting problem." Nurses and therapists also evaluated clients on improvement in functioning in group therapy and outside the hospital. Further, at least one family member was interviewed to assess client functioning outside of the hospital.

Outcome was gauged by the client's score on the first varimax-rotated factor derived from the correlational matrix of ratings by clients, nurses, and therapists. This factor was labeled "Client-Rated Improvement" and was loaded primarily by items dealing with the client's estimate of global benefit from group therapy, including the item dealing with changes in "complaint or symptoms that brought you for treatment." Note that the study did not directly ask about changes in drinking status.

The primary statistical analysis was a 2×2 analysis of covariance. CL of therapist and client served as independent variables, verbal IQ as a covariate, and standardized score on the client improvement factor as the dependent variable. The main effects were not significant. However, the client-therapist CL interaction effect was highly significant ($p<.005$), indicating that matched clients rated their improvement as higher than did those mismatched to therapists.

McLachlan (1974) provided 12- to 16-month followup data on these clients and, further, examined the impact of two different venues for providing aftercare as they interact with client CL.

The two types of aftercare were:

- Weekly meetings and weekly phone calls for the first year following inpatient treatment.
- Letters to clients encouraging them to write to another client who was a member of the inpatient therapy group.

Drinking data were available for 87 of the original 92 clients. Seven additional clients missing posttreatment data in the 1972 study were added. Outcomes were classified according to a 4-point ordinal scale from "no improvement" to "fully abstinent since treatment." Informants for determining followup status were clinic secretaries (who also played a role in treatment), a counselor, a physician, and fellow clients who had maintained contact with the client since discharge. When ratings were inconsistent across sources, the lower rating was selected for purposes of the outcome evaluation.

Urban clients received the first type of aftercare described and out-of-town clients received the second, "low structure," type of aftercare. Clients were distinguished as matched or mismatched based on their CL being high or low and their treatment being high or low in structure. Outcomes were dichotomized by combining no improvement and some improvement

categories (39 percent of clients) and much improvement and fully abstinent categories (61 percent of clients).

Analyses focused on how matching to inpatient group therapist related to outcome and how matching to the two types of aftercare related to outcome. Both types of matching were associated with about the same rate of recovery (70 percent) and both kinds of mismatching with about the same rate of recovery (50 percent). Seventy-seven percent of the "doubly matched" clients had favorable outcomes but only 38 percent of the "doubly mismatched" clients were judged as recovered.

Beyond McLachlan's work specifically on alcoholics, the topic of matching clients to psychological treatments and students to educational interventions has proven quite popular, and a comprehensive review of these studies has been prepared by Stoppard and Miller (1985). Due to the number of such studies, only some of the general conclusions are offered:

- Most research has dealt with "contemporaneous" matching (i.e., matching of clients with treatments based on the client's current CL) rather than "developmental" matching (i.e., trying to enhance the clients' CL by placing them in a setting slightly above that appropriate to their current CL).
- Client satisfaction or reported comfort is a common outcome measure for such studies since CL theory posits that therapeutic rapport and empathy are strengthened when clients are assigned to interventions based on CL. A small number of studies (e.g., McLachlan's), however, have looked at the effect of matching on resolution of client problems.
- With the exception of McLachlan's (1972) study, degree of formal intervention structure has served as the treatment variable.
- Only 20 percent of the reviewed studies failed to discover a matching effect. Also, only one study discovered a matching effect *inconsistent* with CL theory, and this study was rather poorly controlled.
- Research on CL far more typically reveals interaction effects than main effects.
- Most matching studies have revealed ordinal effects, with low CL clients responding better when matched to condition. High CL individuals seem less affected by differences in treatment structure.

The Matching Hypotheses

Clients higher in CL will have a higher percentage of days abstinent when treated by Motivational Enhancement Therapy (MET; Miller et al. 1992) than by Twelve Step Facilitation (TSF; Nowinski et al. 1992). Conversely, clients lower in CL will do better in this regard when treated by TSF.

Clients higher in CL will consume more alcohol on the days in which they do drink when treated by TSF than when treated in MET. Conversely, clients lower in CL will do better in TSF.

The hypothesized interaction effect is portrayed in figure 1.

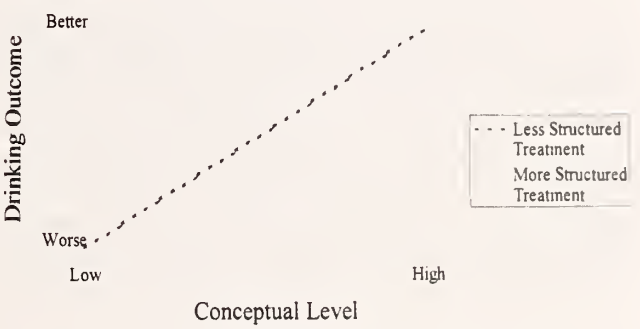

Figure 1. Hypothesized matching effect for conceptual level.

Measurement

CL in Project MATCH was measured using the PCM. The test consists of seven brief stems alluding to basic life themes such as parent roles. Clients are asked to complete each stem by writing at least three sentences describing their reactions. Guidelines in the manual (Hunt

et al. 1978) provide general principles for scoring responses according to degree of CL demonstrated. The manual also offers numerous examples of various level CL responses for each stem. The client's score is the average of the highest three responses.

Psychometric properties of the PCM were computed using as a subject pool the first 40 clients from each of 8 research sites and 38 from the ninth. The observed frequency distribution was generally normal, with skewness and kurtosis of only -0.34 and 0.29, respectively. Although only nine clients failed to attempt the PCM, nearly 16 percent of the item responses were unscorable due to paucity of content.

Interrater reliability, split-half reliability, and coefficient alpha based on 103 response protocols were 0.73, 0.41, and 0.49, respectively. Factor analysis revealed that the first unrotated principal component accounted for 35 percent of the total variance and, with the exception of a single item, all items loaded at at least 0.55. The parents item correlated at only 0.13 with the first principal component score.

Results

The hypothesized model predicted that the interaction of type of treatment (TSF versus MET) and conceptual level of the client would be significantly related to drinking outcome. Figure 2 schematizes the relationship actually observed on the outcome variable percentage of days abstinent. Above and below the line respectively are the *p*-values for the outpatient arm and the aftercare arm of MATCH. Neither is statistically significant.

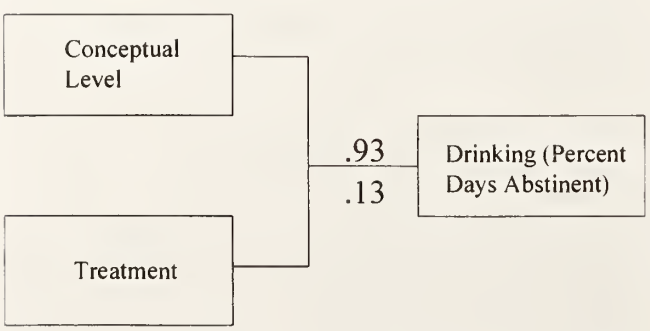

Figure 2. P-values of relationships of CL and treatment to drinking outcome.

At least three reasons seem possible for the failure to demonstrate the predicted effect. Obviously, there may, in fact, be no relationship in nature between the variables, despite the earlier findings reported by McLachlan (1972, 1974) and the generally positive findings noted by Stoppard and Miller (1985) in the educational literature. (A recently reported study (Nielsen et al. 1998) has also found that matching alcoholic outpatients to degree of treatment structure was associated with treatment retention. Unlike in MATCH, however, this investigation did not deal with drinking outcomes per se.)

The second possibility lies with difficulties in scoring the PCM. In our hands, the interrater reliability of the measure was only 0.73, despite a 1-week training course given to the raters. Factor analysis of the PCM as well as coefficient alpha also suggested that the content of the PCM is heterogeneous.

Thirdly, it was assumed that TSF would be more structured than MET. This was only demonstrated in the outpatient arm of the trial. Nevertheless, the relationship of degree of structure of treatment and conceptual level to drinking was not significant in either arm of the study.

Future research on the relationship of conceptual level of the client and degree of alcoholism treatment structure might more profitably employ an alternative measure to the PCM as well as contrast treatments differing in structure more extremely than the interventions in Project MATCH. Interventions might also be assessed against other relevant, but nondrinking, outcomes such as treatment retention and client satisfaction.

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The Search for Meaning in Life as a Predictor of Alcoholism Treatment Outcome

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ABSTRACT

The core literature of Alcoholics Anonymous (AA) identifies two prerequisites for successful affiliation and positive outcome within AA. These are a sense of "hitting bottom" and a willingness to accept and practice a spiritual program for recovery. This chapter presents the rationale and operational definition for client *meaning-seeking*, a composite measure intended to represent these characteristics. A prospective matching hypothesis was developed in Project MATCH which stated that meaning-seeking and posttreatment percentage of days abstinent would be positively and strongly related within the Twelve Step Facilitation (TSF) condition, whereas a weaker positive relationship would be found in the combined Cognitive-Behavioral Coping Skills (CBT) and Motivational Enhancement (MET) therapies. Similarly, client meaning-seeking and drinking intensity were predicted to be weakly related within the combined CBT and MET conditions, but strongly and negatively related for clients assigned to TSF. Partial support for the prospective matching hypothesis was found in the aftercare sample, but not in the outpatient sample. Proposed causal mechanisms underlying the hypothesis were partially supported in the outpatient sample, and adjustments to the causal model led to partial support of the prospective model in the aftercare sample.

Involvement in Alcoholics Anonymous (AA) is widely recommended as an aid in recovery. Meta-analytic reviews indicate that such engagement is associated with more favorable outcomes (Emrick et al. 1993) and that the magnitude of benefit may vary according to whether clients received prior outpatient or inpatient treatment (Tonigan, Toscova et al. 1996). Substantial effort has been directed toward the identification of predictors of AA affiliation, with at least 62 client characteristics examined in one or more studies. Client attributes most associated with AA affiliation include heavier drinking, more severe alcohol dependence, and experienced loss of control when drinking (Emrick et al. 1993).

Nevertheless, even the strongest predictors of AA affiliation account separately for less than 10 percent of the variance in AA attendance and involvement, indicating that currently identified predictors are of limited clinical utility in identifying whom to refer or not to refer to AA. Predictor variables appear to have been selected most often on the basis of convenience (what can be measured easily) rather than what ought to be measured from a conceptual analysis of AA. We believe that the core literature of

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AA offers some clear predictions of the likely characteristics of AA affiliates, many of which have been ignored in alcohol research.

This chapter describes the rationale and development of one composite variable to predict AA affiliation and involvement for clients assigned to a formal Twelve Step Facilitation (TSF; Nowinski et al. 1992) therapy. The composite variable was derived from a theoretical perspective, combining recommendations made in the core AA literature with findings from AA research. The predictive utility of this composite variable was examined prospectively with the Project MATCH (1993, 1997) clinical samples, the results of which are presented here along with an evaluation of the conceptual causal chain underlying predicted relationships.

Rationale of the Client Matching Variable

The central question underlying this investigation was, "Who will be most likely to affiliate with and derive benefit from AA?" According to the basic "big book" of AA (1976), "hitting bottom" is essential. This bottoming out, as understood in AA, is characterized not so much by catastrophic consequences as by a spiritual/existential bankruptcy and a sense of hopelessness about one's ability to control drinking despite awareness of its consequences. The big book describes hitting bottom as a period of "incomprehensible demoralization" that is necessary but not sufficient for recovery. Also needed, by AA's account, is a *willingness* to accept help and to pursue a spiritual path to recovery. This distinction is reflected both in the common statement in meetings that "AA is not for everybody who needs it, but for those who need it *and* want it," and in advice for working with an alcoholic (Alcoholics Anonymous 1976):

> If he is not interested in your solution, if he expects you to act only as a banker for his financial difficulties or a nurse for his sprees, you may have to drop him until he changes his mind. (p. 95) . . . We find it a waste of time to keep chasing a man who cannot or will not work with you. (p. 96)

Typical research measures of motivation for change do not really capture this concept of hitting bottom. While change readiness is tacitly present in AA's third tradition and in the AA program's emphasis upon "one day at a time" (McCrady 1994), an AA understanding of this critical willingness refers more to a critical desire for meaning in life that is found through spiritual means.

Meaning-Seeking as a Composite Matching Variable

There are two potentially distinct aspects of this spiritual/meaning crisis. One aspect is an experienced *lack of meaning in life*. Crumbaugh and Maholick's (1976) Purpose in Life (PIL) scale was designed specifically to assess current sense of meaning, and it has been used in prior studies of substance abuse (Black 1991). On the PIL, lower scores reflect a relative lack of perceived current life meaning. Such meaning deficit is, we believe, a better operationalization of hitting bottom, as understood in the core AA literature, than are measures of drinking patterns, consequences, or dependence levels. Yet a meaning void alone does not capture the AA element of willingness. A second Crumbaugh (1977) instrument, the Seeking of Noetic Goals (SONG) scale, was developed as a companion measure to the PIL and was designed to assess the extent of *desire for and seeking* of greater meaning in life. Higher scores on the SONG reflect a quest for greater meaning.

Because both elements seem essential to capture AA's understanding of hitting bottom, we reasoned that a difference score (SONG minus PIL) would be a reasonable operational definition. High positive values on this meaning-seeking difference score reflect a low sense of current meaning combined with a strong desire for greater meaning. Negative meaning-seeking values, on the other hand, suggest that current sense of purpose exceeds the desire for greater meaning in life. This difference score can range from +120 (maximum SONG score of 140, minimum PIL score of 20) to -120 (minimum SONG score of 20, maximum PIL score of 140). In this way, meaning-seeking can be conceived as a point along a continuum between these extremes.

Predicted Relationships

A primary matching hypothesis in Project MATCH (1993, 1997) was that higher scores on meaning-seeking (hitting bottom) would predict better outcomes in the TSF treatment, which explicitly focuses on issues of spirituality and meaning (Nowinski et al. 1992). Consistent with core AA writings, we also expected that lower meaning-seeking scores, reflecting distance from hitting bottom, would be associated with poorer outcomes in TSF. This, then, illustrates a testable hypothesis derived directly from AA theory:

In terms of the two primary outcome measures chosen for Project MATCH, we predicted that meaning-seeking and posttreatment percentage of days abstinent (PDA) would be strongly and positively related for clients assigned to TSF, and that meaning-seeking and posttreatment drinks per drinking day (DDD) would be strongly and negatively related for clients assigned to TSF.

We had no reason to predict a relationship between meaning-seeking and outcomes for clients assigned to the other two treatments studied in Project MATCH: Motivational Enhancement Therapy (MET; Miller et al. 1992) and Cognitive-Behavior Coping Skills Therapy (CBT; Kadden et al. 1992). Consequently, we pooled clients in these conditions into a single group and made the prediction that meaning-seeking would be modestly related to outcomes (PDA and DDD) for these non-TSF clients.

An important contribution of the Project MATCH analytic strategy is the requirement that prospective hypotheses delineate and statistically test the causal mechanisms supporting the hypothesis. Our meaning-seeking predictions were based upon the assumptions that the content of the TSF modality would be more relevant to higher meaning-seeking clients and, consequently, meaning-seeking would be more positively related with satisfaction with treatment within the TSF condition than in the combined MET and CBT conditions. In turn, meaning-seeking and two measures of treatment compliance within TSF (AA meeting attendance and percentage of therapy sessions attended) would be more positively related in TSF than in the combined CBT and MET conditions. Finally, we expected that these mechanisms would become manifest in a more positive relationship between meaning-seeking and attendance and involvement in AA both during and after treatment for clients assigned to TSF and that higher AA involvement would predict (and maintain) better outcome (higher PDA and lower DDD).

Results

Of the 1,726 clients studied in Project MATCH, 96 percent provided sufficiently complete data at intake to compute the composite meaning-seeking matching variable. No mean differences were found among the three treatment groups in either the outpatient ($F(2, 914)= 0.14$, $p<.87$) or the aftercare ($F(2, 737)=0.09$, $p<.92$) arms of the study, although clients' mean levels of meaning-seeking did vary significantly within both outpatient sites ($F(4, 910)=3.13$, $p<.014$) and aftercare sites ($F(5, 734)=4.7$, $p<.0003$). A reasonably normal distribution was obtained within each arm for the composite variable (outpatient: $M=-16.50$, $SD=29.09$, skewness=0.17; aftercare: $M=-10.90$, $SD=30.21$, skewness=0.27).

Outpatient Sample

Prognostic Effect of Meaning-Seeking

The prognostic effect of baseline meaning-seeking was examined separately for outpatient and aftercare clients. These analyses were run separately for the treatment period (months 1–3) and for the followup period (months 4–15). Prognostic effects for the primary dependent measures (PDA and DDD) were examined in a hierarchical linear modeling (HLM) context which controlled for site, treatment, and time (linear and quadratic terms) and their interactions with each other and the meaning-seeking attribute (Project MATCH Research Group 1997; Longabaugh and Wirtz, this volume, pp. 4–17).

Baseline meaning-seeking was not predictive of abstinence (PDA) during the 12 weeks of treatment in the outpatient ($p<.17$) sample.

Likewise, no prognostic effect was observed for PDA during the 12 months of followup in the outpatient ($p<.27$) sample. This finding was consistent across sites, evidenced most clearly in the nonsignificant site by meaning-seeking product terms in the HLM tests (all p's >.30). In contrast, at intake, meaning-seeking did predict drinking *intensity* (DDD) during outpatient treatment ($p<.04$), a finding that was relatively consistent across sites (site by meaning-seeking interaction, $p<.39$). Examination of scatter plots indicated that outpatient clients higher in meaning-seeking reported more DDD during treatment, relative to outpatients with lower baseline meaning-seeking scores. The prognostic effect between meaning-seeking and DDD faded during followup (months 4–15) in the outpatient sample ($p<.78$), and little variation in this finding was identified when the matching attribute was crossed by site or treatment condition.

Testing of the Primary Matching Hypothesis

The rationale for testing of the prospective Project MATCH primary hypotheses and protection of type 1 error rate has been described elsewhere (Project MATCH Research Group 1993, 1997; Longabaugh and Wirtz, this volume, pp. 4–17) and will not be repeated in detail. Essentially, 24 HLM tests specifically examined the meaning-seeking hypothesis, 12 conducted from data during treatment and 12 with followup data. The 12 parallel HLM tests included: (1) four tests of the matching hypothesis collapsing time, separately for PDA and for DDD, with aftercare and outpatient samples, (2) the same four tests of the matching hypothesis as it potentially changed in magnitude across time in a linear function, and (3) the same series of four tests of the matching hypothesis as it potentially changed in magnitude across time in a quadratic function.

Figure 1 shows the mean monthly transformed PDA values by the dichotomized meaning-seeking attribute (low: 0 or negative score, high: ≥+1) for outpatients in the TSF condition and in the combined CBT and MET conditions. Consistent with our predictions, high meaning-seeking clients assigned to TSF reported a higher frequency of abstinent days than did low meaning-seeking TSF clients. Twelve months after treatment, for example, high meaning-seeking clients assigned to the TSF condition reported, on average, 7 percent more abstinent days relative to low meaning-seeking clients assigned to the TSF group. Contrary to expectations, however, this same trend—albeit a smaller, 2-percent difference in abstinent days 12 months after treatment—was found in the non-TSF groups, although as reported earlier, the overall prognostic relationship was not statistically significant.

Table 1 provides the probability values associated with the results of the overall and time-bound matching tests of the meaning-seeking attribute for the within-treatment and post-treatment periods for both primary dependent measures. None of the planned tests (n=12) was significant, and only modest variation in matching results was found across outpatient sites.

Also reported in table 1 are the unplanned pairwise matching contrasts for the meaning-seeking attribute. None of these 36 post hoc contrasts supported the matching hypothesis. Thus, for outpatients, we found no support for the prospective and post hoc hypothesis predicting a differential treatment response in frequency and intensity of drinking between TSF and the combined CBT and MET groups on the basis of the meaning-seeking attribute.

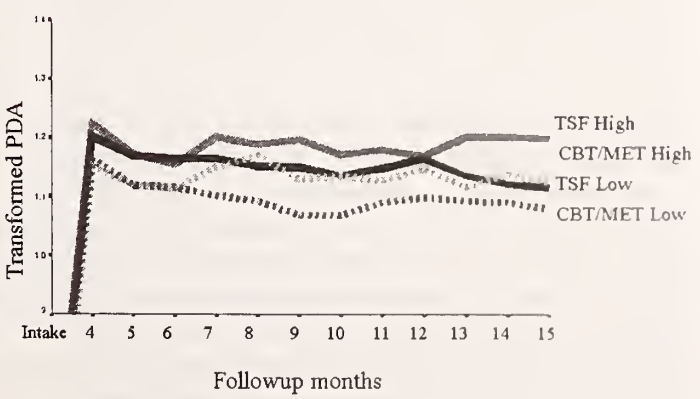

Figure 1. Comparison of high versus low meaning-seeking outpatient clients assigned to TSF and combined CBT and MET. (Percentage of days abstinent for the 12 months after treatment completion.)

Table 1. Summary of a priori and post hoc meaning-seeking matching tests: Outpatient sample (*N*= 952) (probability values)

	Planned contrast	Unplanned contrasts		
	TSF vs. CBT+MET	TSF vs. CBT	TSF vs. MET	CBT vs. MET
During treatment				
Percentage of days abstinent	.85 (.87)[1]	.59	.83	.47
Percentage of days abstinent$_{Linear}$	.60 (.54)	.81	.51	.69
Percentage of days abstinent$_{Quadratic}$	.78 (.94)	.82	.49	.38
Drinks per drinking day	.90 (.86)	.62	.78	.46
Drinks per drinking day$_{Linear}$	.75 (.82)	.62	.96	.67
Drinks per drinking day$_{Quadratic}$	.99 (.89)	.87	.87	.75
Posttreatment: Months 4–15				
Percentage of days abstinent	.32 (.43)[1]	.51	.30	.70
Percentage of days abstinent$_{Linear}$	.90 (.79)	.72	.57	.38
Percentage of days abstinent$_{Quadratic}$	.13 (.11)	.12	.30	.63
Drinks per drinking day	.27 (.46)	.55	.51	.95
Drinks per drinking day$_{Linear}$	.54 (.70)	.77	.71	.93
Drinks per drinking day$_{Quadratic}$	.22 (.21)	.12	.56	.35

[1] Probability values not controlling for site × treatment × matching attribute interaction are in parentheses.

Causal Chain Analyses

The hypothesis predicted that high meaning-seeking clients would feel more comfortable, and be more receptive to, the content of the TSF modality relative to low meaning-seeking clients. This positive response of higher meaning-seeking clients in TSF was predicted to be manifest in greater satisfaction with therapy, higher AA attendance and therapy compliance, and more involvement in AA. Higher involvement in AA was, in turn, expected to lead to more positive outcomes. Client meaning-seeking was expected to be unrelated to the content and processes of the CBT and MET conditions.

Several analytic strategies were used to test the adequacy of the meaning-seeking causal chain. Structural equation modeling (Byrne 1994) was initially chosen to test underlying assumptions of the model, but deletion of cases because of missing process data reduced the outpatient sample by 29 percent and the aftercare sample by 33 percent. The approach eventually adopted was hierarchical multiple regression analyses which, after controlling for site, matching attribute, and treatment main effects, tested the matching attribute by treatment product term (i.e., meaning-seeking by TSF versus CBT+MET combined). In this analysis, rejection of the null hypothesis for the product term would indicate a differential relationship between meaning-seeking and the criterion measure (a variable in our causal model) by the specified treatment contrast. Unstandardized and standardized beta weights were examined to assess the nature of any observed differential relationship between meaning-seeking and a causal variable nested within treatment conditions.

Table 2 summarizes the causal chain analyses for the outpatient sample. Complete support for the prospective model would result in p values $<.05$ under the column heading Interaction, indicating a different relationship (by treatment condition) between meaning-seeking and listed causal variables. Complete support for the model would then have large and positive beta weights for TSF and nonsignificant beta weights for CBT+MET.

Table 2. Summary of causal chain analyses for outpatient sample (*N*=952)

Causal (criterion) variable	Interaction	TSF	CBT+ MET
Therapy process			
Client Satisfaction With Treatment	$p<.067$	.03	.15
WAI: Relationship Bond	$p<.051$	.04	-.10
WAI: Goal Compatibility	**$p<.021$**	-.01	-.18
WAI: Task Compatibility	**$p<.003$**	-.02	-.14
Percent Therapy Sessions Attended	$p<.231$	-.11	-.10
AA attendance			
Months 1–3	**$p<.015$**	.13	.04
Months 4–6	**$p<.041$**	.14	.09
Months 6–9	$p<.160$	.09	.03
AA involvement			
Months 1–3	$p<.961$	.12	.16
Months 4–9	$p<.870$	.09	.10

NOTE: WAI refers to client ratings of the therapeutic relationship (at Week 2 of treatment) using the Working Alliance Inventory (Horvath and Greenberg 1986). Unstandardized β weights.

As shown, findings were mixed in their support of the proposed causal chain. Client meaning-seeking was unrelated to client report of goal compatibility and task compatibility in the TSF condition and was negatively related with report of goal compatibility and task compatibility in the combined CBT and MET conditions. Trends for client satisfaction with treatment and bond with the therapist similarly reflected a negative relationship with meaning-seeking in the CBT+MET condition but not for TSF clients. It appears, therefore, that high meaning-seeking clients found the goals and tasks of TSF less unacceptable than those of the CBT and MET clients combined.

A core assumption was supported by the finding that meaning-seeking predicted AA affiliation in the TSF group but not in the CBT and MET groups. Regression analyses for AA attendance excluded outliers (AA values exceeding 3 *SD* from treatment group mean), although findings did not substantially differ when outlier cases were retained in the analyses. Both during treatment (months 1–3) and for the 3 months immediately following treatment (months 4–6), meaning-seeking was positively and significantly predictive of AA meeting attendance for TSF clients, and meaning-seeking was marginally related to AA attendance in the CBT and MET groups. The predicted relationship was not observed for our measure of AA involvement (Tonigan, Connors et al. 1996).

Figure 2 demonstrates a clear and consistent ranking across 39 months of followup of a trichotomized meaning-seeking variable and percentage of days AA attendance as predicted for TSF clients. Mean values of the meaning-seeking variable were highest for the high meaning-seekers, followed by the medium and low meaning-seekers (at all followups), and post hoc scheffe tests indicated that these differences were significant at 3 ($p<.006$), 12 ($p<.041$), and 15 ($p<.016$) months followup.

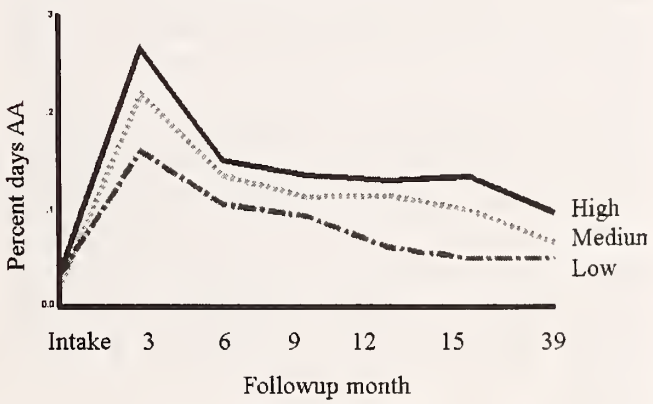

Figure 2. Trichotomized meaning-seeking attribute for TSF outpatient clients.

Did the positive association between meaning-seeking and AA attendance for outpatient TSF clients become manifest in positive outcome? Two hierarchical multiple regression analyses were conducted to examine this question, with summary measures of frequency (PDA) and intensity (DDD) of drinking (months 4–9) separately serving as criterion measures. Site, baseline drinking (PDA and DDD), treatment, and meaning-seeking main effects were entered first, followed by main effect of percentage of days AA attendance and, in the third

block, the product term representing percentage of days AA by the a priori treatment contrast (TSF versus CBT+MET).

The product term with PDA at proximal followup as the dependent measure (months 4–9) was not significant ($p<.13$), indicating no differential relationship between AA attendance and frequency of abstinent days by treatment condition (TSF vs. CBT+MET). The main effect of AA, after controlling for site, treatment, baseline drinking, and meaning-seeking main effects was significant ($p<.0001$) and accounted for 4 percent of variance in frequency of drinking for the first 6 months after the end of treatment. The slope associated with the AA predictor ($b=0.44$, $t(844)=6.28$) was positive, indicating that higher rates of AA attendance during treatment were predictive of higher frequency of abstinent days during followup.

With drinking intensity as the dependent measure, a significant differential relationship was obtained between percentage of days AA attendance during treatment and drinking intensity (months 4–9) by treatment condition (TSF versus CBT+MET), $t(843)=2.14$, $p<.03$. Inspection of DDD regressed on percentage of days AA indicated that, within TSF, DDD was negatively and significantly related with AA attendance ($b=-1.68$, $p<.001$), and that AA attendance and drinking intensity were not related in the combined CBT and MET conditions ($b=-0.80$, $p<.06$). These findings are consistent with the prospective model described above.

Aftercare Sample

Prognostic Effect of Meaning-Seeking

Prognostic effects of the meaning-seeking variable on PDA and DDD were examined during treatment and for the 12 months after treatment. These effects were studied in the context of HLM and, like the analyses for the outpatient sample, these analyses controlled for variation accounted for by site, treatment, and matching attribute main effects and their interactions. Baseline meaning-seeking was not predictive of PDA either during treatment ($p<.19$) or for the 12 months after treatment ($p<.11$) in the aftercare sample. This finding was consistent across the aftercare sites as indicated by the nonsignificant site by meaning-seeking interaction terms. Unlike the outpatient sample, meaning-seeking and drinking intensity were statistically unrelated in the aftercare sample during treatment ($p<.06$) and remained at the trend level of a relationship during the 12 months after treatment ($p<.06$). Little variation across aftercare sites was identified in regard to this trend finding.

Testing of the Primary Matching Hypothesis

Statistical tests of the meaning-seeking hypothesis in the aftercare sample were parallel to the tests conducted in the outpatient sample. Twenty-four tests were conducted; 12 of these focused on the treatment phase of the study, and 12 tests examined the matching hypothesis during the 12 months after treatment.

Figure 3 shows the monthly transformed PDA outcomes for high versus low meaning-seeking aftercare clients in TSF and in the combined non-TSF conditions (low: 0 or negative score, high: ≥1). In the aftercare TSF condition, high meaning-seeking clients fared somewhat less well during early followup (10 percent fewer abstinent days in month 4, $p<.03$), but this pattern reversed into the predicted direction during later months. Contrary to our prediction that meaning-seeking would be less related to PDA in the non-TSF conditions, low meaning-seeking clients consistently fared better than did high meaning-seeking clients

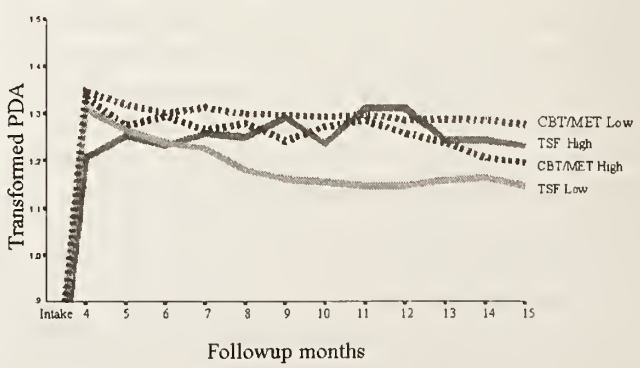

Figure 3. Comparison of high-low meaning-seeking aftercare clients assigned to TSF and combined CBT and MET. (Percentage of days abstinent 12 months after treatment.)

throughout the followup period. Differences in PDA outcome between high and low meaning-seeking in the non-TSF conditions were significant for followup months 7–15, with the largest monthly difference representing 10-percent fewer abstinent days for high meaning-seeking clients.

Table 3 gives the probability values associated with the 12 matching tests of the meaning-seeking hypothesis in the aftercare sample. No support was found for the hypothesis during the treatment phase of the study on either PDA or DDD. A significant attribute by treatment (TSF versus CBT+MET) by $time_{Linear}$ interaction was found, however, on the PDA measure for followup months 4–15. This nondirectional interaction test was significant after Bonferroni correction for type 1 error, indicating that the magnitude of the difference in slopes for the specified treatment contrast varied across time. Monthly followup tests were conducted to ascertain if the change in slopes across time was in the predicted direction, and this was partially confirmed. In this regard, monthly contrasts for months 5 through 14 were $p<.05$, with only baseline drinking covaried; monthly contrasts for months 11, 12, and 13 were $p<.10$ when adjusted for baseline drinking, site, and site by time effects. No support was found for the predicted meaning-seeking hypothesis using the DDD primary outcome measure during the 12 months of followup. Inspection of directional monthly contrasts suggested that the absence of a differential treatment response between meaning-seeking and drinking intensity was consistent across time, and little variation was observed between meaning-seeking and drinking intensity when crossed by site and time.

Table 3 also gives the results of 36 unplanned pairwise contrasts of the matching hypothesis. As shown, two contrasts, both for PDA_{Linear} months 4–15, were significant. These contrasts involved separately testing CBT and MET against TSF and indicate that the planned contrast that was significant (TSF versus CBT+MET, PDA_{Linear} months 4–15) was not the result of either CBT or MET "pulling" the combined outcome for these groups in a particular

Table 3. Summary of a priori and post hoc meaning-seeking matching tests: Aftercare sample (N=774)(probability values)

	Planned contrast	Unplanned contrasts		
	TSF vs. CBT+MET	TSF vs. CBT	TSF vs. MET	CBT vs. MET
During treatment				
Percentage of days abstinent	.95 (.92) [1]	.65	.57	.26
Percentage of days $abstinent_{Linear}$	.63 (.79)	.77	.57	.75
Percentage of days $abstinent_{Quadratic}$	.16 (.69)	.49	.07	.21
Drinks per drinking day	.37 (.58)	.68	.24	.39
Drinks per drinking day_{Linear}	.77 (.88)	.59	.99	.54
Drinks per drinking $day_{Quadratic}$	.50 (.94)	.68	.43	.67
Posttreatment: Months 4–15				
Percentage of days abstinent	**.27 (.05)**	.09	.78	.12
Percentage of days $abstinent_{Linear}$	**.01 (.003)**	**.04**	**.02**	.69
Percentage of days $abstinent_{Quadratic}$	**.07 (.02)**	.10	.10	.99
Drinks per drinking day	.57 (.33)	.29	.96	.22
Drinks per drinking day_{Linear}	.49 (.27)	.38	.72	.57
Drinks per drinking $day_{Quadratic}$	.16 (.05)	.13	.32	.55

[1] Probability values excluding the site × treatment × matching attribute interaction are in parentheses.

direction. In this regard, the contrast of CBT and MET (PDA_{Linear} months 4–15) should not be significant, which was the case.

Causal Chain Analyses

The prospective hypothesis was partially supported in the aftercare sample, but only on the abstinence measure and only midway through the 12 months of followup. Examination of the causal mechanisms underlying the hypothesis was undertaken to untangle the complex matching findings. As before, hierarchical regression analyses were conducted with attention directed to the interaction term as evidence of a differential relationship between meaning-seeking and causal variables. Likewise, extreme values of percentage of days AA attendance led to the removal of a limited number of cases, and findings did not differ when these cases were included in the analyses.

Table 4 gives the results of the causal chain analyses for the aftercare sample. Surprisingly, despite the partial support for the matching hypothesis in the aftercare sample on the frequency of drinking measure, none of the tests of a differential relationship between meaning-seeking and causal variables was significant. Specifically, no differential relationship was found between meaning-seeking and therapy process, AA attendance, or AA involvement measures. The only trend ($p<.10$) was in a direction opposite to that predicted: Meaning-seeking was negatively related with AA involvement during treatment for TSF clients.

Additional analyses were conducted to identify where the meaning-seeking assumptions went astray. A major concern was the discrepancy between outpatient and aftercare samples in the relationship between meaning-seeking and subsequent AA attendance for TSF clients. Many aftercare clients received exposure to AA principles and attended AA meetings during their formal inpatient treatment experience. In tandem with the fact that the TSF modality was highly effective in boosting AA attendance, it is plausible that the proposed relationship was overwhelmed in the aftercare sample because of uniformly high AA attendance rates in each of the three treatment conditions.

Table 4. Summary of causal chain analyses for aftercare sample ($N=774$)

Causal (criterion) variable	Interaction	TSF	CBT+ MET
Therapy process			
Client Satisfaction With Treatment	$p<.939$	.10	.06
WAI: Relationship Bond	$p<.450$	-.12	-.04
WAI: Goal Compatibility	$p<.737$	-.09	-.11
WAI: Task Compatibility	$p<.890$	-.08	-.04
Percent Therapy Sessions Attended	$p<.239$	.04	-.07
AA attendance			
Months 1–3	$p<.804$	.06	.07
Months 4–6	$p<.780$	.04	.02
Months 6–9	$p<.361$	.11	.04
AA Involvement			
Months 1–3	$p<.060$	-.10	.08
Months 4-9	$p<.153$	-.07	.05

NOTE: WAI refers to client ratings of the therapeutic relationship (at Week 2 of treatment) using the Working Alliance Inventory (Horvath and Greenberg 1986). Unstandardized β weights.

We reasoned that while meaning-seeking may not have predicted differential rates of AA exposure at *specific* followup points, the matching variable may have predicted different patterns of AA attendance across time, which, in turn, might explain the partial matching effect. Tonigan and colleagues (in press) reported, for example, that discrete patterns of AA attendance in Project MATCH included the following categories:

1. No AA attendance
2. AA attendance during the 12 weeks of treatment only
3. AA attendance during treatment with some attendance during followup up to but not past month 9
4. Sustained AA attendance during treatment and all followup months

5. Erratic AA attendance during and after treatment, with months between AA meeting attendance

Discarding the last category because of the limited number of cases, we conducted a Chi square test (4 × 6) to determine whether pattern of AA attendance (four categories) varied across the trichotomized meaning-seeking attribute nested within the a priori matching contrast (six categories).

Figure 4 depicts the interaction of interest ($\chi^2(15)=29.80$, $p<.013$), and offers substantial support for the underlying rationale of the meaning-seeking causal chain. In particular, about 60 percent of the medium and high meaning-seeking clients assigned to aftercare TSF attended AA throughout the treatment and followup phases of the study. In comparison, about 50 percent of the low meaning-seeking clients assigned to aftercare TSF reported sustained AA attendance. In contrast, high and medium meaning-seeking clients assigned to CBT and MET attended AA throughout the study about as much as low meaning-seeking clients assigned to TSF.

An important question was, did this finding replicate in the outpatient sample? Findings ($\chi^2(15)=203.41$, $p<.0001$) suggest that the general relationship between patterns of AA attendance and meaning-seeking is stable in both the aftercare and outpatient samples. Specifically, high and medium meaning-seekers assigned to the outpatient TSF treatment reported more sustained AA attendance throughout the study than did low meaning-seekers in TSF. In addition, low meaning-seeking clients in TSF reported more sustained AA attendance than high meaning-seeking clients assigned to either CBT or MET. Not predicted, proportionally more high meaning-seekers assigned to TSF discontinued AA attendance after treatment than did low and medium meaning-seekers assigned to TSF.

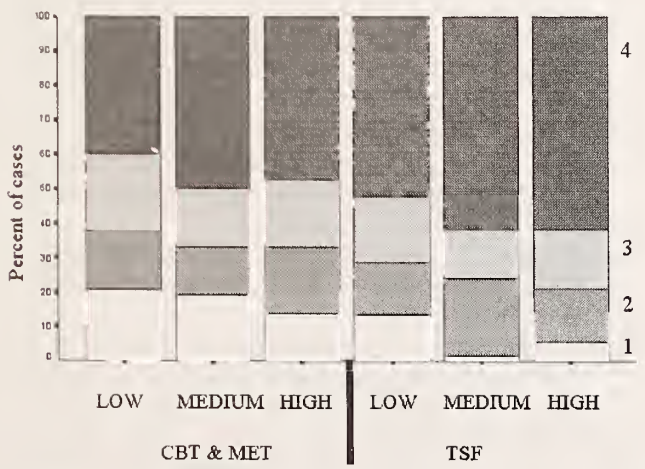

Figure 4. Patterns of AA attendance by trichotomized meaning-seeking attribute within matching treatment contrast (aftercare sample). 1 = No AA attendance; 2 = AA attendance during 12 weeks of treatment only; 3 = AA attendance during treatment with some attendance during followup up to but not past month 9; 4 = Sustained AA attendance during treatment and all followup months.

Discussion

What can be learned from these complex findings? Some aspects of the predicted causal chain were supported, and others were not. The TSF treatment did significantly increase AA attendance, relative to the CBT and MET groups, in both arms of the trial. We did not find, however, that high meaning-seeking clients were differentially enthusiastic and compliant with the TSF treatment, as we had predicted. If anything, the higher meaning-seekers were differentially *unenthusiastic* about the goals and tasks presented to them in outpatient CBT and MET, and this relationship was absent in TSF. Thus, although the expected pattern (positive slope for TSF and no relationship for other groups) was not found, the direction of differential preference was as predicted for outpatients.

Planned causal chain analyses did not explain the partially supported meaning-seeking matching effect in the aftercare sample. Our hypothesis that meaning-seeking would be more strongly and positively related with treatment compliance and AA attendance within TSF during treatment was not supported.

Was the absence of a differential relationship between meaning-seeking and AA attendance the result of the unexpected and high overall rate of AA attendance in the aftercare sample? Post hoc analyses support this interpretation. In particular, high and medium meaning-seeking clients assigned to aftercare TSF had more

sustained AA attendance throughout the study than low meaning-seeking clients in TSF. This relationship was tacitly assumed in the causal model but not explicitly specified in the a priori causal chain model.

We believe findings in the outpatient and aftercare samples can be meaningfully integrated. First, client meaning-seeking was predictive of different rates (outpatient) or patterns (aftercare) of AA attendance. In the outpatient sample, this relationship became manifest quickly because it was unconfounded by prior inpatient treatment emphasis on AA. In the aftercare sample, this relationship was confounded by initially high rates of AA attendance in all treatments, but became manifest in the latter part of the study. In both samples, the assumption that client meaning-seeking was positively predictive of comfortability with treatment tasks, goals, and therapist bonding was not supported. Whether these findings will be replicated with more detailed process-oriented variables warrants future research.

The key mechanism of increased AA attendance in the meaning-seeking causal model was supported in both samples, but the predicted matching effect was only partially obtained in the aftercare sample. Why? It is our belief that a focused and high threshold in formal 12-step emphasis is required to produce the matching effect, a threshold met in the aftercare sample but not for TSF outpatients. If true, 12-step focused therapies should consider methods to enhance treatment fidelity when implementing client treatment matching strategies.

Before drawing conclusions, some caveats are in order. First, Project MATCH was not designed as a study of AA per se, but only of a Twelve-Step Facilitation therapy as one of three approaches in treating alcohol problems. Measures of AA attendance and involvement such as those selected for use in this trial implicitly assume that AA is a homogeneous entity. In fact, there are substantial differences among AA groups, and stronger affiliation and prognostic profiles might emerge from analyses sensitive to AA group heterogeneity (Montgomery et al. 1993; Tonigan et al. 1995).

It is also possible that the measure of meaning-seeking used in this study, albeit normally distributed, was not optimal as an operational definition of hitting bottom. It showed only a weak prognostic relationship to treatment outcomes in general and largely failed to predict differential response to treatments. Future studies might seek a multivariate definition of hitting bottom that includes not only meaning-seeking but other measures such as severity of negative consequences and dependence, depression and hopelessness, and perceived lack of personal control over drinking. Factor or cluster analytic strategies could be applied to identify the complex phenomenon of hitting bottom. Alternatively, a criterion-referenced definition could be derived by regression strategies. Although this contains some risk of logical circularity, hitting bottom is in fact popularly conceptualized as the final crisis that precedes recovery.

Acknowledgment

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Religiosity and Responsiveness to Alcoholism Treatments

Gerard J. Connors, Ph.D., J. Scott Tonigan, Ph.D., and William R. Miller, Ph.D.

ABSTRACT

The proposition evaluated in this chapter is that clients who are more comfortable with religious beliefs and practices would derive greater benefit from a treatment that incorporated spiritual themes and practices. In terms of the Project MATCH treatments, it was expected that clients with higher levels of religiosity would benefit more from the Twelve Step Facilitation (TSF) treatment than would clients lower in religiosity. No relationship beyond a weak prognostic effect of religiosity on treatment outcome was predicted for clients in the Cognitive-Behavioral Coping Skills Therapy or Motivational Enhancement Therapy conditions. Tests of this matching hypothesis revealed no support for the predicted match among either the outpatient or aftercare populations sampled. The evaluation of the causal chain presumed to underlie the hypothesized matching effect showed limited support for the proposed chain among aftercare clients, where it was found that religiosity among the TSF clients was linearly related to the degree of therapeutic task compatibility. In terms of other analyses, it was found that aftercare clients reported greater religiosity at pretreatment than did outpatient clients and that pretreatment religiosity predicted positive posttreatment drinking outcomes. Taken together, religiosity did not emerge as a viable matching dimension with the treatments evaluated in Project MATCH, although it does appear that religiosity may play a role in the prediction of the therapeutic relationship among aftercare clients and of posttreatment drinking behavior. Future research on these relationships will help specify the role of religiosity in alcoholism treatment and identify circumstances under which religiosity might productively be focused on in the treatment endeavor.

Despite the consistent indication that religion plays a significant role in many people's lives (e.g., Hoge 1996), there has been remarkably little research on the role of religiosity and religious beliefs in treatment specifically and the behavior change process more generally. This lack of systematic research attention has been evident in the general psychotherapy literature as well as in addictions treatment research (Larson et al. 1998).

Project MATCH provided the opportunity to evaluate differential outcomes associated with response to three alcoholism treatments as a function of pretreatment levels of client religiosity. To our knowledge, no prospective study has examined whether client religiosity interacts with alcoholism treatment modalities to produce differential outcomes. In the arena of treatment for depression, Propst (1980) found in a randomized trial that religiously oriented clients with depression fared better when spiritual themes were integrated into a cognitive restructuring intervention than when such material was omitted, regardless of the religious

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orientation of the therapist. Propst et al. (1992) subsequently replicated this finding in another clinical trial, demonstrating differential ineffectiveness of "nonspiritual" cognitive-behavioral therapy for religious-oriented depressed individuals when treated by nonreligious therapists.

As described in detail elsewhere (Project MATCH Research Group 1993), three treatments were employed in Project MATCH: Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992), Motivational Enhancement Therapy (MET; Miller et al. 1992), and Twelve Step Facilitation (TSF; Nowinski et al. 1992). The use of these three treatments with two distinct clinical populations—outpatients and aftercare clients—permitted the evaluation of predictions regarding differential outcomes associated with extent of client religiosity and participation in these three treatments. The proposition developed for evaluation in this chapter is based on a "comfort model" between client characteristics and treatment philosophy and content. In this regard, it was expected that clients who are more comfortable with religious beliefs and practices would derive greater benefit from a treatment that incorporated spiritual themes and practices. In terms of the Project MATCH treatments, it was expected that clients with higher levels of religiosity would benefit more from the TSF treatment than would clients lower in religiosity. No relationship beyond a weak prognostic effect of religiosity was predicted for the CBT and MET conditions.

There are a variety of ways in which spiritual dimensions manifest themselves in a 12-step-based intervention. A review of the 12 steps reveals a heavy emphasis on faith in God (Step 2), surrender to God's will (Step 3), prayer and continued meditation (Step 11), and other spiritual behaviors (Steps 8–10). A therapeutic focus on these issues was hypothesized to be more comfortable, acceptable, and effective specifically for clients more attuned to and/or in need of personal religiosity.

The TSF treatment used in Project MATCH was designed in part to encourage and facilitate attendance at and participation in Alcoholics Anonymous (AA) meetings. There have been modest positive correlations reported between client religious and spiritual practices and AA affiliation. For example, extent of religious and spiritual activities, such as prayer and meditation, has been found to be positively related to AA affiliation (Fichter 1982; Laundergan and Kammeier 1978). Relatedly, Harris et al. (1990) reported that individuals who felt that God actively worked in their lives were significantly more likely to affiliate and that direct experiences of God also were positively related to affiliation.

The present chapter describes the evaluation of the matching hypothesis that individuals higher in religiosity would benefit more from the TSF intervention than would clients lower on this dimension, and that there would be no such relationship (beyond a weak prognostic effect) among clients receiving the CBT and MET interventions. In addition, the causal chain developed to account for the proposed match is described and evaluated.

Methods

Operationalizing Religiosity

The total score from the Religious Background and Behaviors (RBB) questionnaire (Connors et al. 1996) was used to assess religious practices. The RBB is composed of 13 items. On the first item, clients identified the term that best describes them: atheist, agnostic, unsure, spiritual, religious. On the following six items, the clients indicated (on an 8-point Likert scale) the frequency with which they had engaged in the following behaviors during the past year: thought about God, prayed, meditated, attended worship services, read/studied scriptures/holy writings, and had direct experiences of God. The last six items assessed these domains in terms of lifetime occurrence on a 3-point ordinal scale. The item content was intended to capture behaviors traditionally associated in the literature with religiosity. Past year and lifetime assessments were used so that recent religious behaviors could be identified.

The first item of the RBB was assigned a score from 0 to 4, ranging from atheist to religious (atheist=0, agnostic=1, and so forth). The

remaining items were recoded before summing to calculate summary scale scores. Specifically, each of the remaining responses was reset such that 1=0, 2=1, 3=2, 4=3, and so forth. This procedure was implemented to establish an RBB scale scoring floor of zero (rather than 13).

Psychometric evaluation of the RBB (Connors et al. 1996) has shown that the measure comprises two factors, labeled God Consciousness and Formal Practices, and that the RBB possesses excellent test-retest reliability and satisfactory internal consistency. In this regard, the test-retest correlation over a 3-day interval was found to be 0.97, and the internal item consistency for the combined study arms (outpatient and aftercare) at intake to be 0.86 (N=1637).

Statement of the Matching Hypothesis

A single between-group slope contrast was proposed with regard to the interaction of pretreatment religiosity and treatment in influencing two drinking outcome variables: percentage of days abstinent (PDA) and drinks per drinking day (DDD). *Specifically, it was predicted that (a) religiosity and PDA would be significantly and positively related within the TSF condition, with a weaker relationship manifest within the combined CBT and MET conditions and (b) religiosity and DDD would be significantly and negatively related within the TSF condition, with a weaker relationship manifest within the combined CBT and MET conditions.*

Statement of the Causal Chain

It was predicted that the TSF therapeutic focus would be more acceptable to clients reporting such behaviors as regular practice of prayer, meditation, direct experiences of God, and reading of scriptures. This acceptability was predicted to become manifest in higher rates of TSF therapy attendance (relative to clients with lower levels of religiosity), higher rates of AA attendance and involvement during the 12 weeks of treatment, and more positive client reports of the client-therapist therapeutic alliance (as measured in the second week of treatment using the Horvath and Greenberg (1986) Working Alliance Inventory (WAI)). It was believed that these facets of the therapeutic process combined would lead to more positive posttreatment outcomes.

Results

Preliminary Analyses

General sample characteristics for the two arms of the study are described elsewhere (Project MATCH Research Group 1997). Examination of baseline RBB total scores indicated that aftercare clients reported significantly higher (p<.01) mean RBB scores (M=38.61, SD=11.31) than outpatients (M=35.36, SD=10.94), with no main effect of gender on RBB mean scores (p<.06). Intake RBB total scores were weakly and positively related with AA attendance in the 90 days prior to study recruitment (r=0.11 for outpatients, r=0.13 for aftercare clients), and involvement in AA for the year prior to recruitment was moderately related with RBB total scores (r=0.22 for outpatients, r=0.27 for aftercare clients).

Virtually no relationship was found within study arm (outpatient, aftercare) between RBB scores and measures of psychiatric severity (Alcohol Severity Index (ASI; McLellan et al. 1980) psychiatric severity subscale and the Beck Depression Inventory (BDI; Beck et al. 1961)), with the largest absolute value of r equal to 0.05. In terms of the two primary dependent measures (PDA and DDD, assessed at baseline), RBB scores were more related to PDA, having a weak association in the aftercare arm (r=0.15) and a weaker yet association in the outpatient arm (r=0.08). Consistent with measures of alcohol consumption, RBB scores were unrelated or weakly related to adverse consequences reported by aftercare clients (r=0.01) and outpatients (r=0.10).

Aftercare Sample

Prognostic Effect of RBB

The prognostic effect of baseline RBB scores on treatment outcome was examined in two phases. First, the univariate correlations between scores on the RBB and the trial's two primary outcome measures (PDA and DDD) were

calculated for the 6-month period following the end of treatment. The correlation between RBB scores and PDA was 0.08 ($p<.05$) and between RBB scores and DDD was -0.02 ($p>.50$). Looking at the RBB subscales, the correlations between the God Consciousness subscale scores and PDA and DDD, respectively, were 0.03 ($p>.40$) and 0.02 ($p>.50$). The correlations between the Formal Practices subscale scores and PDA and DDD, respectively, were 0.10 ($p<.01$) and -0.05 ($p>.15$).

Next, the prognostic effect of RBB scores on treatment outcome was examined after controlling for baseline drinking, site, treatment, and time (linear and quadratic) main effects and their interactions. Analyses of the prognostic effects of this secondary matching variable on the trial's two primary outcome measures (PDA and DDD) were thus derived from the larger hierarchical linear modeling (HLM) analyses examining potential matching effects of the RBB variable.

A significant and positive main effect of the RBB on PDA for months 4–15 was found after controlling for baseline drinking, site, time, and treatment main effects and their interactions ($p<.01$). This finding indicated that RBB scores at intake were linearly related to PDA across the 12-month posttreatment period. Post hoc dismantling of the total RBB measure into its two subscales (God Consciousness and Formal Practices) suggested that extent of self-reported formal religious practices (e.g., regularity of church attendance) accounted for the overall prognostic effect. Although RBB scores positively predicted the frequency of abstinence (i.e., PDA), no relationship in the aftercare arm was found between baseline RBB scores and drinking intensity (i.e., DDD) during the 12 months of followup ($p<.48$). Little variation by site was found ($p<.16$), and examination of the relationship between drinking intensity and the two subscales of the RBB likewise suggested the absence of a statistically or clinically significant finding.

Matching Effects

The formal RBB matching hypothesis stated that RBB and posttreatment PDA would be positively related within the TSF condition and that a weaker relationship would be found between RBB and PDA within the combined CBT and MET conditions. It was also predicted that RBB and DDD would be negatively related in the TSF condition and, again, that a weaker relationship would be found between RBB and DDD within the combined CBT and MET conditions.

Testing of the RBB matching hypothesis was conducted using the HLM procedure. Discussed in detail elsewhere (Project MATCH Research Group 1997; Longabaugh and Wirtz, this volume, pp. 4–17), this procedure led to the testing of the a priori contrast in three ways: (1) an overall matching effect involving slope comparisons of TSF versus CBT and MET collapsed across time, (2) a contrast of TSF and CBT and MET slopes as they changed across time in a linear function, and (3) changes across time in the specified contrast in a quadratic context. Thus, conducted separately for aftercare and outpatient samples, 6 significance tests (3 tests × 2 dependent measures, PDA and DDD) were used to evaluate the RBB matching hypothesis.

Table 1 summarizes the probability values derived from the HLM analyses using PDA and DDD as the primary dependent measures in the a priori RBB secondary matching hypothesis. Findings are presented for the 12-week phase of treatment labeled "during treatment," and for the 12-month posttreatment period labeled "after treatment." Along with the planned contrast labeled TSF versus CBT+MET, three unplanned pairwise contrasts are reported for exploratory purposes. None of the a priori contrasts supported the prediction of a differential relationship by treatment between intake RBB scores and PDA or DDD during treatment or during the 12 months of followup. Likewise, none of the exploratory post hoc pairwise contrasts supported the hypothesis that the relationship between PDA and RBB scores would vary by treatment condition.

Casual Chain Analyses

Lack of support for the RBB secondary matching hypothesis led us to question whether the proposed therapeutic mechanisms failed to become operative during treatment as predicted

Table 1. Summary of aftercare HLM religiosity and responsiveness to treatment hypothesis tests: Probability values associated with tests of during and after treatment client-treatment matching

	Predicted match TSF vs. MET+CBT	Unplanned matching contrasts		
		TSF–CBT	TSF–MET	CBT–MET
During treatment				
PDA	.39	.43	.50	.91
PDA linear	.91	.92	.92	.69
PDA quadratic	.19	.09	.09	.24
DDD	.21	.30	.25	.91
DDD linear	.75	.83	.73	.90
DDD quadratic	.19	.52	.11	.34
After treatment				
PDA	.18	.21	.30	.82
PDA linear	.45	.36	.70	.60
PDA quadratic	.56	.69	.54	.83
DDD	.40	.64	.32	.60
DDD linear	.39	.40	.52	.83
DDD quadratic	.84	.78	.94	.83

or, instead, whether proposed mechanisms became operative during treatment but failed to influence treatment outcomes as predicted. Path analyses were used to examine these questions, dividing treatment outcomes as either proximal (months 4–9) PDA and DDD or as distal (months 10–15) PDA and DDD. Several strategies were evaluated in deriving estimates of posttreatment drinking outcome. Monthly PDA and DDD values were considered most consistent with the HLM analyses, but conducting 12 path analyses for each primary dependent measure would result in 48 analyses across the two study arms, which would be clearly undesirable from a type 1 error rate perspective. Alternatively, selection of a few months to examine the proposed mechanisms had merit, but how were months to be selected? In the end, we considered the proximal and distal measures to be both clinically relevant and more stable indices of posttreatment functioning.

Figure 1 shows the path analytic findings separately for the TSF and combined CBT and MET conditions in the aftercare sample. The first link in the causal chain predicted a more positive relationship between the three measures depicting therapeutic working alliance collected after the second week of therapy and pretreatment RBB scores in the TSF condition relative to the combined CBT and MET conditions. This prediction was partially supported. In the TSF condition, pretreatment RBB scores were significantly and positively related to client agreement on TSF therapeutic tasks, but not to agreement on therapeutic goals and client-therapist bonding. Also predicted, these measures describing therapeutic alliance were unrelated to pretreatment RBB scores in the combined CBT and MET groups.

The second link of our causal model predicted that increased comfortableness with therapy at Week 2 would result in higher rates of AA attendance during treatment, increased therapy compliance—measured by therapy attendance—and greater satisfaction with therapy when measured at the 3-month followup. Only one of nine possible relationships in the TSF path analysis supported this prediction, i.e., WAI goal predicting satisfaction with treatment (β=0.26, p<.05). Thus, we concluded that the second link in our casual model was not tenable. Finally, we proposed that increased AA and therapy attendance and satisfaction with treatment would produce more positive outcomes. This prediction received strong support on both primary dependent measures at proximal and distal followup periods for both TSF and the combined CBT and MET groups.

Outpatient Sample

Prognostic Effects of RBB

The correlations between baseline RBB scores and PDA and DDD (for the 6-month period following treatment), respectively, were

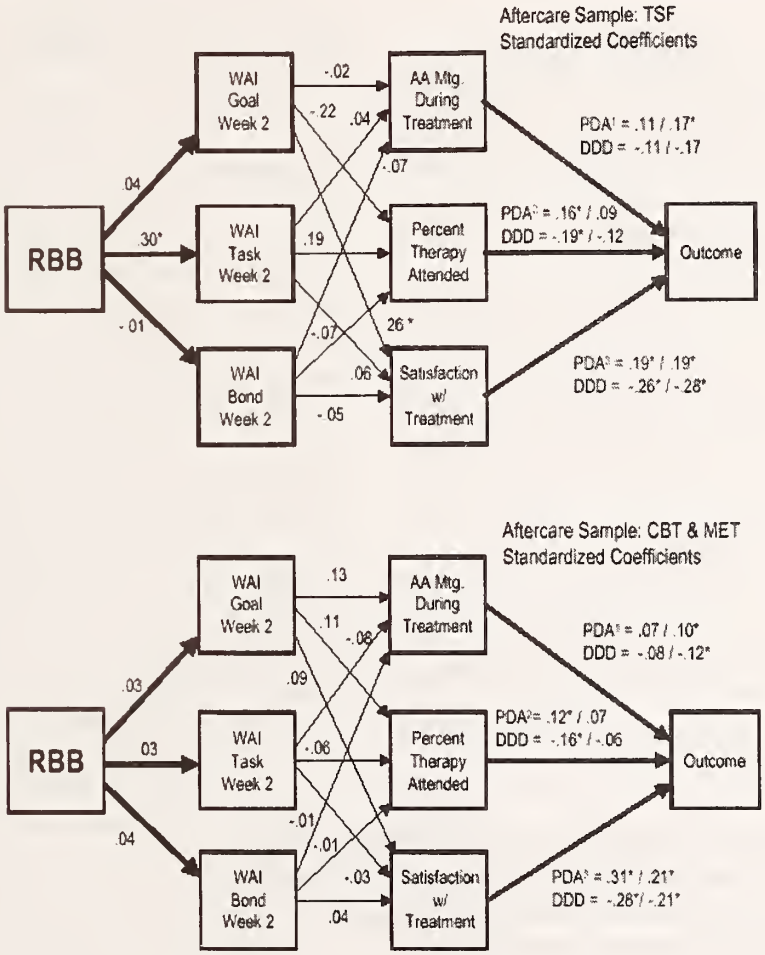

Figure 1: Comparison of aftercare TSF and combined CBT and MET path analysis models assessing religiosity as a differential predictor of treatment response. For the PDA and DDD outcomes, the superscripts (1, 2, 3) indicate that in each case the first number provided (before the slash) is the result for the proximal (months 4–9 posttreatment period) outcome, and the second number after the slash is the result for the distal (months 10–15 posttreatment period) outcome.

0.08 ($p<.05$) and -0.07 ($p<.10$). The correlations between the God Consciousness subscale scores and PDA and DDD, respectively, were 0.09 ($p<.01$) and -0.04 ($p>.25$). The correlations between the Formal Practices subscale scores and PDA and DDD, respectively, were 0.06 ($p<.10$) and -0.07 ($p<.05$).

The prognostic effect of RBB scores on outcome next was examined after controlling for baseline drinking, site, treatment, and time (linear and quadratic) main effects and their interactions. As before, these analyses of the prognostic effects of this secondary matching variable on the PDA and DDD were thus derived from the larger HLM analyses examining potential matching effects of the RBB variable. Baseline RBB scores and frequency of posttreatment abstinence were not related in the outpatient arm ($p<.29$). Examination of the RBB interactions with site and time indicated minimal variation, and, hence, limited qualification to these main effect analyses. RBB scores, however, were significantly and negatively predictive of posttreatment drinking intensity such that higher baseline RBB scores were predictive of less DDD during the 12 months of posttreatment followup ($p<.044$). Study of the two RBB subscales showed that much of this prognostic effect was accounted for by the Formal Practices scale.

Matching Effects

The a priori RBB matching hypothesis was identical for outpatient and aftercare clients, and the proposed mechanisms in our causal model paralleled those described for the aftercare sample. Table 2 provides the probability values associated with the HLM tests of the during and after treatment periods using the two primary dependent measures. Unplanned pairwise contrasts are also provided for exploratory purposes. As shown, none of the planned contrasts for the RBB matching hypothesis were supported on either dependent measure either during or after treatment. Likewise, accounting for the large number of significance tests, no support was found for a differential effect of pretreatment RBB scores in any of the unplanned pairwise contrasts reported in table 2. Consistent with findings in the aftercare sample, no support was found for asserting that pretreatment religiosity is an important consideration in assigning clients to treatments similar to those offered in Project MATCH.

Table 2. Summary of outpatient HLM religiosity and responsiveness to treatment hypothesis tests: Probability values associated with tests of during and after treatment client-treatment matching

	Predicted match TSF vs. MET+CBT	Unplanned matching contrasts		
		TSF–CBT	TSF–MET	CBT–MET
During treatment				
PDA	.38	.43	.48	.90
PDA linear	.79	.88	.75	.89
PDA quadratic	.98	.92	.95	.88
DDD	.55	.64	.57	.95
DDD linear	.71	.67	.83	.82
DDD quadratic	.99	.83	.84	.69
After treatment				
PDA	.80	.95	.80	.86
PDA linear	.62	.78	.25	.17
PDA quadratic	.34	.09	.91	.07
DDD	.77	.86	.75	.90
DDD linear	.88	.20	.28	.02
DDD quadratic	.85	.96	.69	.67

Causal Chain Analyses

Figure 2 shows the path analysis models depicting the proposed mechanisms underlying the RBB a priori hypothesis. Like the aftercare analyses, treatment outcome was divided according to proximal (months 4–9) and distal (months 10–15) periods. Standardized coefficients (β) indicated that the first link of our model was not supported in the TSF condition. Specifically, pretreatment RBB scores were not predictive of client perceptions of therapeutic working alliance at 2 weeks in the TSF condition. Further, with one exception (WAI task agreement and AA meeting attendance, $\beta=0.25$, $p<.05$), perceptions of therapeutic working alliance were not predictive of mechanisms proposed to effect differential outcomes, i.e., increased AA and therapy attendance and greater treatment satisfaction. As among the aftercare participants, the expectation that the increased AA and therapy attendance and satisfaction with treatment would produce more positive outcomes was generally supported for both TSF and the combined CBT and MET groups. Thus, the mechanisms proposed in the model to effect change (AA attendance, therapy attendance, treatment satisfaction) did so. Although these factors predicted change, the effect was not differential across treatment modalities as would be required for matching to occur.

Discussion

The formal testing of the hypothesis that pretreatment religiosity would be positively related to posttreatment drinking outcomes within the TSF condition and only weakly related within the combined CBT and MET conditions was not supported. As such, it does not

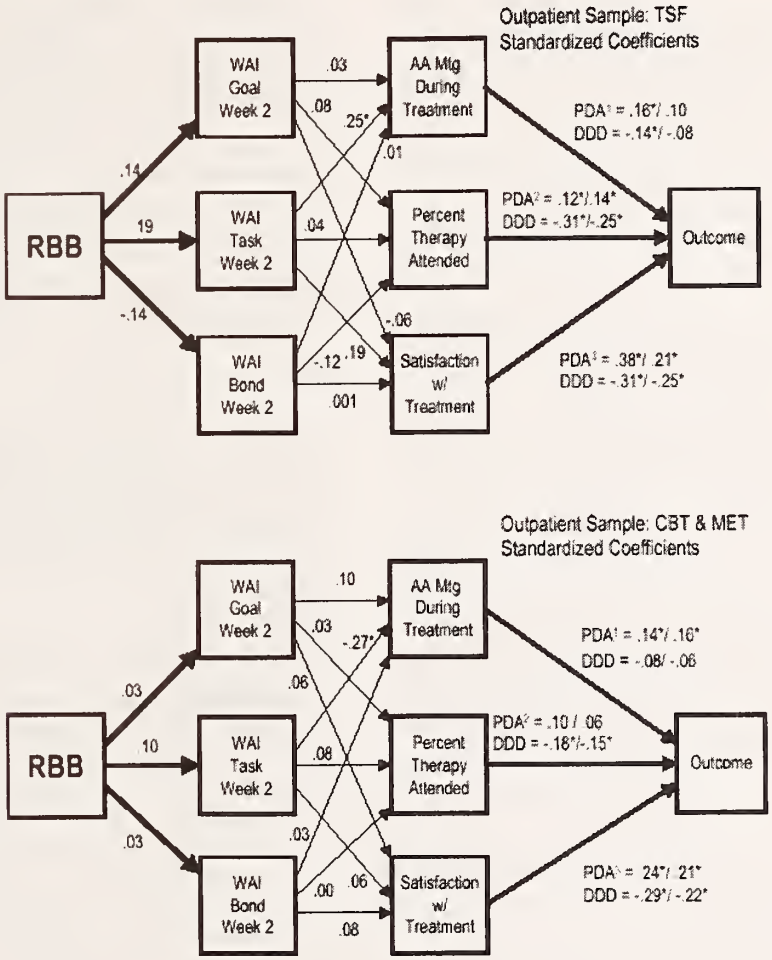

Figure 2: Comparison of outpatient TSF and combined CBT and MET path analysis models assessing religiosity as a differential predictor of treatment response. For the PDA and DDD outcomes, the superscripts (1, 2, 3) indicate that in each case the first number provided (before the slash) is the result for the proximal (months 4–9 posttreatment period) outcome, and the second number after the slash is the result for the distal (months 10–15 posttreatment period) outcome.

appear that matching clients on the basis of religiosity to these alcoholism treatments will yield differential outcomes (at least as assessed in the context of percentage of days abstinent and drinks per drinking day).

The evaluation of the causal chain for the outpatients provided no support for the presumed underlying mechanisms of the hypothesis. In this regard, there was no differential relationship by treatment (TSF versus CBT and MET combined) between level of religiosity and therapeutic alliance. It would appear at the least that this matching hypothesis was not supported because of the erroneous assumption that a 12-step approach would be more acceptable to clients higher in pretreatment religiosity.

A different picture emerged from the causal chain analysis for the aftercare clients. Here it was found that religiosity within the TSF condition was positively related to one of the dimensions of the therapeutic alliance (task compatibility). There was no such relationship for aftercare clients in the other two treatment conditions. Thus, there was some support for the causal chain in the aftercare arm, although it did not manifest itself in increased engagement in the proposed active ingredients of TSF. However, the paths between this alliance component and AA attendance during treatment were not significant.

Although the aftercare causal chain analyses provided support for certain links in the chain, most links were unconnected. For example, therapeutic alliance did not lead to greater levels of AA attendance during treatment. Nevertheless, the finding that religiosity was positively related to one aspect of therapeutic alliance among aftercare clients is noteworthy and might be pursued productively in subsequent research on engaging clients in the therapeutic process and on the working alliance between clients and therapists more generally.

The results discussed above concern the role of religiosity in differential relation to the TSF and combined CBT and MET treatments. However, there were other, more general, findings that are noteworthy and have implications for future clinical research. First, it was of interest that aftercare clients reported greater levels of religiosity than did outpatients. It is possible that the relationship between religiosity and therapeutic alliance in a 12-step facilitation treatment will be evident in clients with an overall higher level of religiosity (as in the case of these aftercare clients). However, this possibility is speculative, and there exists a host of other explanations that might account for that relationship emerging in this aftercare population.

A second finding of note was that pretreatment religiosity predicted outcomes in both the outpatient and aftercare arms of the trial, albeit on different outcome measures. Religiosity positively predicted posttreatment percentage of days abstinent (but did not predict drinks per drinking day) among aftercare clients, and negatively predicted drinks per drinking day (but did not predict percentage of days abstinent) among the outpatients. Thus, in each case religiosity was associated with better outcomes. Interestingly, these prognostic effects in both cases appeared to be carried by the formal religious practices scale of the RBB measure. This is consistent with the more general robust finding that religious involvement is a protective factor against the development of alcohol problems (Gorsuch 1995).

Taken together, these findings raise several interesting questions for subsequent clinical research on religiosity. While religiosity did not emerge as a viable matching dimension with the treatments evaluated in Project MATCH, it does appear that religiosity may play a role in the prediction of the therapeutic relationship (at least among aftercare clients) and of posttreatment drinking behavior. Future research on these relationships will help specify the role of religiosity in alcoholism treatment and identify circumstances under which religiosity might productively be focused on in the treatment endeavor.

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The Interpersonal Dependency Matching Hypothesis

Robert G. Rychtarik, Ph.D.

ABSTRACT

Individuals high in interpersonal dependency were predicted to have better outcomes when assigned to Twelve Step Facilitation (TSF) treatment relative to either Cognitive-Behavioral Coping Skills Therapy (CBT) or Motivational Enhancement Therapy (MET). TSF was thought to satisfy their dependency needs by stressing reliance on a "higher power" and the support and nurturance of the Alcoholics Anonymous (AA) group. Their higher level of attendance and satisfaction with TSF treatment and their high level of AA involvement were predicted to mediate their improved outcomes over interpersonally dependent individuals in CBT and MET. Individuals low in interpersonal dependency, on the other hand, were predicted to have better outcomes in CBT and MET relative to TSF. These clients were predicted to benefit most from CBT and MET, which emphasize individual self-management and self-change, respectively. These hypotheses were not supported. Some limited support was found for the notion that within the MET outpatient sample, high interpersonally dependent individuals had slightly poorer posttreatment outcome in percentage of days abstinent than did those low in interpersonal dependency. At long-term followup, results also suggested that, among the more intense treatments (i.e., CBT and TSF), high interpersonally dependent individuals fared better on drinking intensity outcomes relative to those low in interpersonal dependence. These effects, however, were small. Limitations of the interpersonal dependency measure and the need to study interpersonal dependency in the context of other variables are discussed.

Contemporary conceptualizations define interpersonal dependency as the extent to which an individual strives for and works to maintain nurturant, supportive relationships (Bornstein 1992). The interpersonal dependency construct has been associated with the development and progression of alcoholism for some time. As summarized by Bornstein (1992), several correlational studies have shown a positive association between dependency and alcoholism. Overall, alcoholic individuals have been found to have higher scores on dependency measures than abstainers or social drinkers, even when controlling for other psychopathology.

Prospective, longitudinal research, however, suggests that premorbid dependency level does not predict subsequent risk for the onset of alcoholism (Jones 1968, 1971; Kammeier et al. 1973; Vailant 1980). Rather, dependency-related behaviors (e.g., dependent thoughts, feelings, and behaviors) show a significant increase upon the development of alcohol problems. Thus, interpersonal dependency appears to be a result of the alcohol problem rather than the cause of it. Nevertheless, level of interpersonal dependency at the time of treatment may in turn influence subsequent relapse and treatment outcome and may interact with treatment approach.

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Rationale for the Matching Hypothesis

A basic assumption of the Twelve Step Facilitation (TSF; Nowinski et al. 1992) approach is that recovery from alcohol dependence can be achieved through redirecting an individual's dependency needs onto a "higher power" and creating dependence on the support and nurturance of the Alcoholics Anonymous (AA) group. This approach contrasts markedly with the Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992) and Motivational Enhancement Therapy (MET; Miller et al. 1992) approaches in which emphasis is placed, in general, on an individual's own self-management and decision-making. The current hypothesis is, therefore, based on the assumption that the level at which an individual strives for and works to maintain supportive relationships (i.e., level of interpersonal dependency) will interact with treatment type to influence outcome.

Individuals high in interpersonal dependency are hypothesized to be more responsive to the TSF model given that it complements their own cognitive schema and addresses their own psychological needs by providing and stressing the importance of reliance on supportive relationships with a higher power and the AA group. It is hypothesized that individuals high in interpersonal dependency will benefit most from the TSF condition because they will work harder to win the approval of their therapist and the support group and will attend AA more frequently.

While highly dependent individuals also may be compliant and learn new skills in the CBT condition over the course of treatment, they may have difficulty implementing and/or maintaining them in the posttreatment environment in the absence of additional structured support and nurturance for such change—which is particularly important for them. Thus, these individuals are hypothesized to have poorer outcomes under the CBT condition.

Similarly, highly dependent individuals also are hypothesized to benefit less in the MET condition due to the fewer treatment sessions available upon which to develop the therapeutic relationship, level of support, and nurturance required by these individuals. In addition, as with the CBT condition, the absence of structured support and nurturance posttreatment may make it more difficult for these individuals to implement and/or maintain treatment gains.

It should be noted that while differences may exist between the CBT and MET conditions during treatment (due primarily to the intensity of treatment provided and the opportunity for individuals high in interpersonal dependency to develop a strong therapeutic relationship), the current hypothesis focuses on posttreatment functioning and predicts no difference between CBT and MET in the long term.

Individuals low in interpersonal dependency are hypothesized to respond less favorably to the TSF group relative to the CBT and MET conditions due to their already higher levels of self-reliance and less need for the high level of support and nurturance that may be present in self-help groups. These individuals may respond most favorably to CBT and MET given the emphasis on self-management and self-change in these conditions. In fact, individuals low in interpersonal dependency are hypothesized to view the TSF treatment as less acceptable given its heavy emphasis on reliance on others and therefore may fail to follow through with treatment and AA group attendance.

Individuals low in interpersonal dependency are not hypothesized to differ with respect to outcome between the CBT and MET conditions. These individuals are predicted to do well in the planned absence of any additional posttreatment support that characterizes these two treatment conditions.

Recent research on the interaction between family functioning and interpersonal autonomy (a measure of interpersonal dependency) provides some support for the current hypothesis. McKay and colleagues (1992) found that interpersonal autonomy alone did not predict drinking outcome at posttreatment. Autonomy, however, was found to interact with pretreatment family functioning to predict outcome. Clients who were low in autonomy and who reported high levels of family dysfunction at pretreatment had poorer drinking outcomes at followup. Among high-autonomy subjects, however, pretreatment family functioning was unrelated to

drinking at followup. Thus, individuals with high levels of interpersonal dependency (i.e., low autonomy) appear to be vulnerable to more and heavier drinking in the absence of supportive, nurturing relationships in the family. Individuals with low levels of dependency (i.e., high autonomy) appear to be immune from the effects of family dysfunction. Importantly, this effect was found only for male clients.

In a subsequent report, McKay and associates (1993) found that for low-autonomy individuals, perceived improvement in family functioning during treatment was associated with better outcome at followup. For high-autonomy individuals, however, no significant association between improvement in family functioning and outcome was found. Taken together, while the studies by McKay and colleagues do not specifically address the current hypothesis, they do provide some of the first empirical support for the possible mediating role of interpersonal dependency in alcoholism treatment outcome.

Finally, some additional indirect support for the current hypothesis can be derived from research on predictors of affiliation with AA. Among other variables, high affiliative and group dependency needs have been suggested in some studies to be associated with affiliation with AA (see Ogborne and Glaser 1981). Importantly, AA affiliation also has been positively associated with improved outcome among individuals during and following treatment (Emrick et al. 1993). Thus, the improved outcome predicted for high interpersonal dependency individuals in the TSF condition may result from their greater affiliation with AA during and after treatment.

To summarize, empirical research on the interaction between interpersonal dependency and treatment type is extremely limited. The theoretical support for the above hypothesis far outweighs the empirical evidence, hence the current hypothesis is necessarily exploratory in nature.

The Matching Hypothesis

The dependency by treatment interaction hypothesis can be summarized as follows. *The higher the level of interpersonal dependency prior to treatment, the higher the percent of posttreatment abstinent days (and the lower the number of drinks per drinking day) in the Twelve Step Facilitation relative to the Cognitive-Behavioral Coping Skills Therapy and Motivational Enhancement Therapy conditions. The lower the interpersonal dependency prior to treatment, the higher the percentage of abstinent days (and the lower the number of drinks per drinking day) under the MET and CBT conditions and the lower the percentage of abstinent days (and higher drinks per drinking day) under TSF.* In sum, interpersonal dependency was expected to be positively associated with outcome in TSF but to have a negative or nonsignificant relationship with outcome in both CBT and MET.

Figure 1 gives a diagrammatic presentation of the variables and pathways within each treatment condition hypothesized to mediate the interaction between interpersonal dependency and treatment type. The figure depicts the pathways from pretreatment interpersonal dependency to attendance, treatment satisfaction, posttreatment AA involvement, and subsequent proportion of abstinent days. It was anticipated that the pathway from interpersonal dependency to proportion of treatment sessions attended would be significant and positive in the CBT and TSF conditions but not in the MET condition.

In addition, it was hypothesized that the positive dependency-attendance relationship would be higher in TSF relative to CBT. Interpersonal dependency also was anticipated to be strongly related to higher levels of treatment satisfaction at the end of treatment among participants in TSF relative to participants in either CBT or MET. In fact, higher levels of dependency were predicted to be negatively related to satisfaction with treatment among MET participants.

Interpersonal dependency also was predicted to have positive direct and positive indirect effects (i.e., through attendance and treatment satisfaction) on AA involvement during the posttreatment period among TSF participants but not among participants in either CBT or MET. This effect, in turn, was anticipated to indirectly and positively influence subsequent

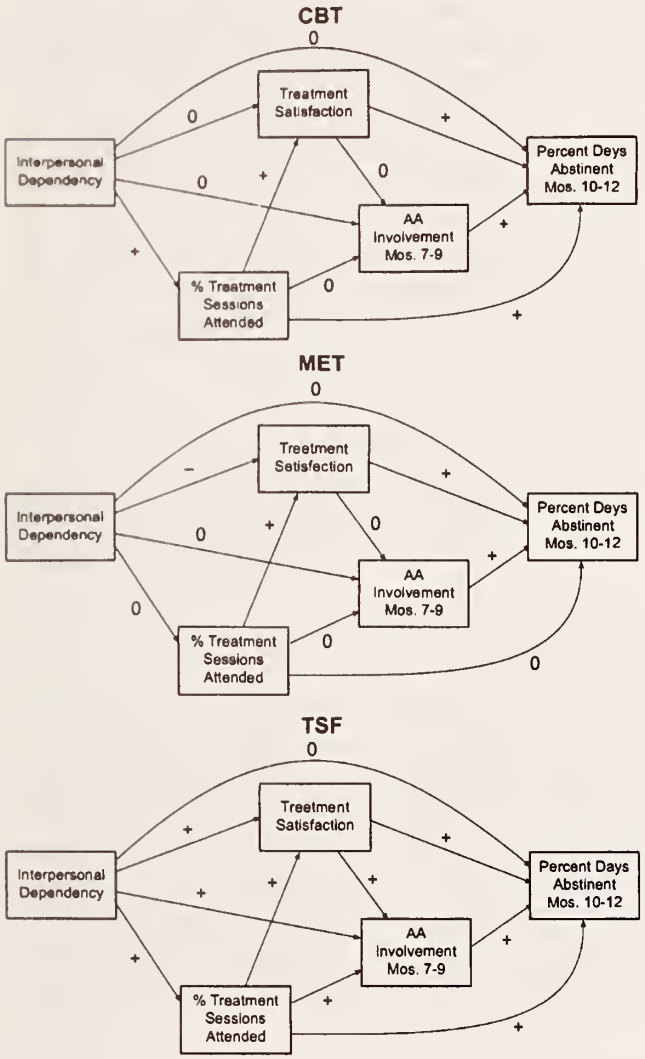

Figure 1. Causal model of the interpersonal dependency by treatment interaction hypothesis

percentage of days abstinent and negatively influence drinks per drinking day in the TSF group.

It should be noted that no significant direct effect of interpersonal dependency on outcome was predicted. Rather, interpersonal dependency was predicted to indirectly affect outcome through its direct effects on treatment attendance, treatment satisfaction, and AA involvement. As shown in figure 1, these indirect pathways were all predicted to be positive in the TSF condition but either negative or nonsignificant (designated "0" in the figure) in the CBT and MET conditions. A similar model (not shown) also was applied to the drinks per drinking day variable. For this outcome measure, however, better functioning was exhibited by lower levels of drinking.

Operationalization of the Matching Variable

Interpersonal dependency was measured using the 14-item Assertion of Autonomy Scale (AAS) of the Interpersonal Dependency Inventory (IDI; Hirschfeld et al. 1977). The IDI is one of a number of widely used measures of dependency (Bornstein 1992) and overall shows good reliability and construct validity. The AAS is one of three factor-analytically derived scales of the IDI. The scale is proposed to measure the extent to which individuals profess to be indifferent to or independent of the evaluation of others and the extent to which they express the belief that their self-esteem depends on the approval of others. Hirschfeld and associates (1977) reported a cross-sample factor-analytic congruency coefficient of greater than 0.80 for this scale. Split-half reliability coefficients in three different samples ranged from 0.72 to 0.91. As administered, high scores on this scale reflect higher levels of independence and thus lower levels of interpersonal dependency.

Responses on the AAS have not been found to be influenced by age, social desirability, depression, or anxiety. Educational level has shown a small but significant positive relationship with autonomy. Also, men have been found to report significantly higher levels of autonomy than women (Hirschfeld et al. 1977). The AAS was also successfully used in McKay and colleague's (1992, 1993) research examining influences on drinking outcome (see above). For the purpose of the present hypothesis, scoring was reversed on the AAS so that high scores on the scale reflected higher levels of interpersonal dependency.

Results

Findings regarding the hypothesized prognostic association between alcohol involvement and each of the two primary outcome measures, percentage of days abstinent (PDA) and drinks per drinking day (DDD), are presented first.

Next, the results of tests of the predicted interaction for each arm and each outcome measure are given. Finally, the variables hypothesized to account for the interaction (or its failure) are shown using path analyses. Results are presented separately for outpatient and aftercare arms.

Outpatient Arm

Prognostic Effect of Interpersonal Dependency

No significant interpersonal dependency effect or dependency by time interaction was observed for either PDA or DDD during either the period of treatment or 12-month followup among outpatients. The effect of interpersonal dependency did approach significance at the 39-month followup ($p<.0649$).

Interaction of Interpersonal Dependency With Treatment

Table 1 presents results of the tests of the overall interpersonal dependency by treatment interaction terms for PDA and DDD for both treatment and followup periods. Also included are tests of the effects of the interaction over linear and quadratic time as well as tests of the individual treatment contrasts. No overall significant treatment by interpersonal dependency interaction was found in the outpatient arm within the treatment period. During the posttreatment period, however, the dependency by treatment interaction approached noncorrected significance ($p=.054$) for PDA. Individual contrasts indicated this potential interaction reflected differences in slopes between CBT and MET and not the predicted differences between TSF and CBT or MET. The nature of this potential interaction on PDA collapsed across the followup period, using multiple regression procedures, is further depicted in figure 2. Consistent with our hypothesis, there was a significant, though small, negative association between interpersonal dependency and PDA in the MET condition. However, no significant dependency-PDA association was found in either the CBT or TSF groups.

At the 39-month followup, the interaction between interpersonal dependency and treatment condition approached significance for PDA ($p=.09$) and was significant at the uncorrected level of $p=.02$ for DDD. The latter interaction, however, was not in the predicted direction. As shown in figure 3, there was no significant relationship between interpersonal dependency and DDD in the MET condition. In both the CBT and

Table 1. Interpersonal Dependency—Outpatient

Treatment contrast		Within treatment						Posttreatment					
		MV × Tx		MV × Tx × T		MV × Tx × T^2		MV × Tx		MV × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	*F*	1.41	-.71	.93	.51	-.05	-1.36	2.41	-1.81	-.11	-1.02	-2.02	.67
	p	.15	.48	.35	.61	.96	.18	**.02**	.07	.91	.31	**.04**	.50
CBT–TSF	*F*	.16	.76	1.01	-.11	.01	-1.58	.94	-.24	-1.19	.88	-1.29	.90
	p	.87	.44	.31	.91	.99	.11	.35	.81	.23	.38	.20	.37
MET–TSF	*F*	-1.22	1.42	.06	-.60	.06	-.18	-1.47	1.54	-1.02	1.82	.76	.19
	p	.22	.16	.96	.55	.95	.85	.14	.12	.31	.07	.44	.85
MV × Tx	*F*	1.15	1.01	.64	.21	.00	1.49	2.92	1.85	.83	1.66	2.12	.45
	p	.31	.36	.53	.81	1.00	.22	.054	.16	.43	.19	.12	.64

MV = matching variable, Interpersonal Dependency; Tx = treatment; T = linear time; T^2 = quadratic time; PDA = percentage of days abstinent; DDD = drinks per drinking day

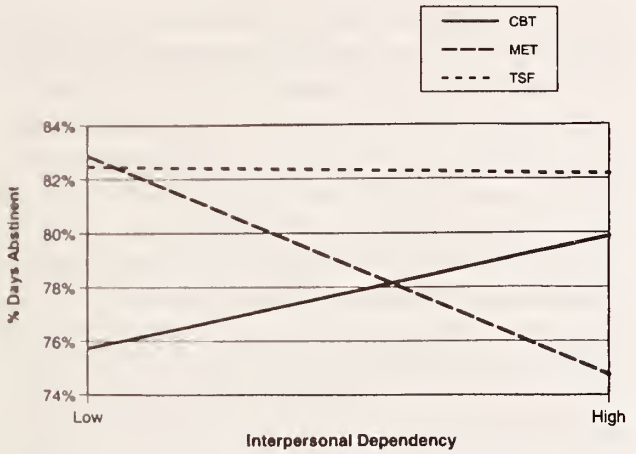

Figure 2. Nature of interpersonal dependency by treatment interaction approaching significance for Percentage of days abstinent across followup months 4–15 in the outpatient arm.

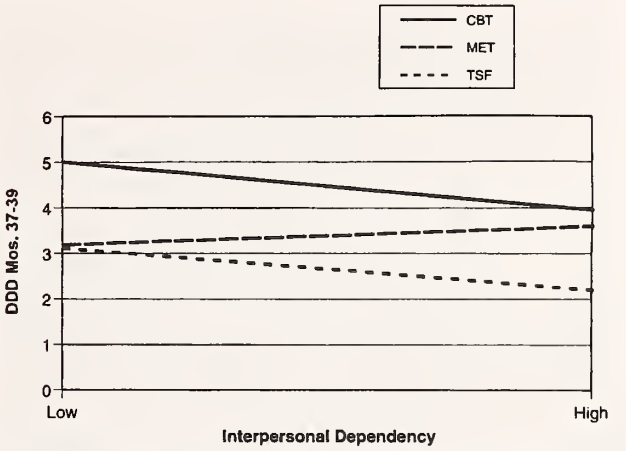

Figure 3. Noncorrected significant interpersonal dependency by treatment interaction on drinks per drinking day (DDD) for long-term followup months 37–39 in the outpatient arm.

TSF conditions, however, higher levels of interpersonal dependency were associated with fewer drinks per drinking day. This effect occurred in the presence of a significant main treatment effect (p=.0251) which favored TSF.

These results must be viewed with caution given the long-term nature of the followup. Nevertheless, the findings suggest that level of interpersonal dependency is not related to drinking intensity outcomes in low-intensity treatments such as MET. In higher intensity treatments, however, the higher the interpersonal dependency, the better the outcome.

It is interesting to note that at high levels of interpersonal dependency, the predicted effect was supported (i.e., individuals were doing better in TSF than in either CBT or MET). At low levels of interpersonal dependency, however, TSF and MET both appear to result in better outcomes than CBT. The essentially parallel slopes of TSF and CBT, however, indicate that the relationship between interpersonal dependency and DDD is not significantly different between these treatments. Yet, because of the main effect for TSF, the level of outcome is different between the two groups.

The A Priori Causal Model

As noted above, there was no support for the hypothesized interaction between interpersonal dependency and treatment assignment. To identify the reasons for this failure, the hypothesized causal model presented in figure 1 was examined within a structural equations framework with posttreatment followup drinking data.

The treatment satisfaction measure was the sum of 4 items on a posttreatment questionnaire which asked the clients to rate, on a 5-point scale, their satisfaction with the therapist (1 = Very Satisfied, 5 = Very Dissatisfied), whether they would return to the program in the future (1=Definitely Yes, 5=Definitely Not), the extent to which the program met their needs (1=Almost all of my needs have been met, 5= None of my needs have been met), and their overall satisfaction with the treatment received (1 = Very Satisfied, 5 = Very Dissatisfied). Preliminary analyses indicated that these 4 items formed a single factor which accounted for 68.5 percent of the variance. The internal consistency of this satisfaction measure was 0.84. For the purposes of this analysis, scoring of the satisfaction measure was reversed so high scores represented greater treatment satisfaction. AA involvement was measured using the AA Involvement Scale (Tonigan et al. 1996) administered at the 9-month (6 months posttreatment) followup. Treatment attendance represented the proportion of treatment sessions attended. The effect of these measures on predicting the PDA during followup months 10–12 was examined. The arcsine transformation was used for the attendance and PDA variables.

The path model was analyzed separately for each of the treatment groups and in a multigroup analysis using EQS (Bentler 1995). Analyses included only those clients for whom complete data on all variables in the model were available (*N*'s of 238, 222, and 268 for CBT, MET, and TSF, respectively). The overall chi square was used to assess the comparability of the model across the different treatments. The results of the multiple-group analysis for PDA and DDD are presented in figures 4 and 5, respectively. A partially constrained model fit the data best for both PDA, χ^2=6.92, df=12, n.s., and DDD, χ^2=10.97, df=12, n.s. Consistent with the hypothesis, AA involvement in months 7–9 was positively and significantly related to PDA in months 10–12, regardless of treatment condition. Moreover, as expected, proportion of sessions attended in TSF had a positive and significant effect on AA involvement that was not found in either CBT or MET. Similarly, higher satisfaction at posttreatment was significantly associated with more AA involvement in TSF but not in the other two treatments. The failure of the hypothesized interaction is evident, however, in the fact that interpersonal dependency

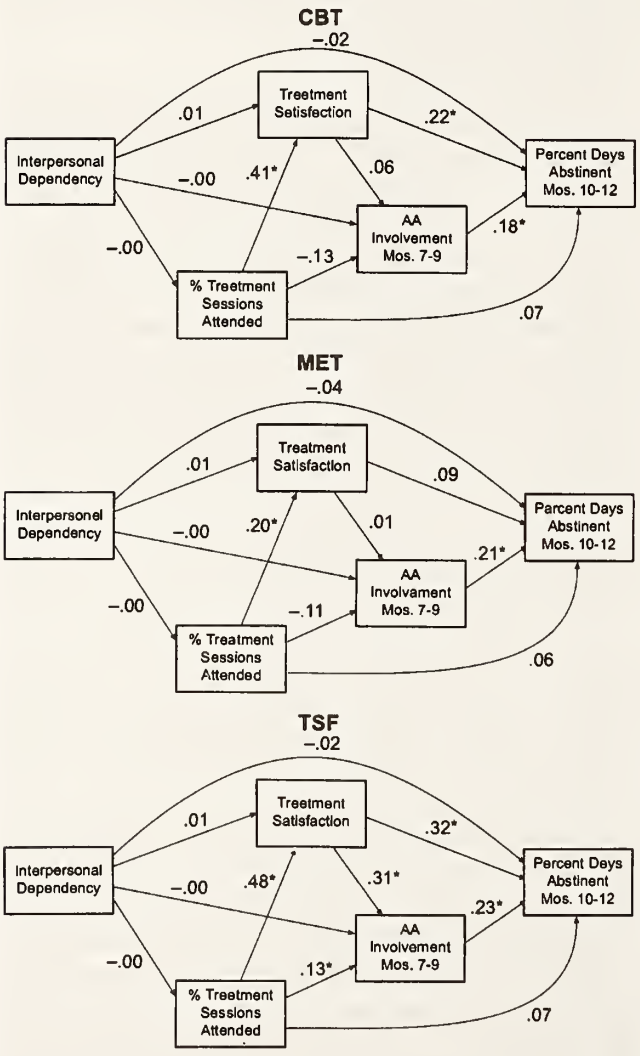

Figure 4. Multiple-group comparison of the causal model applied to percentage of days abstinent in the outpatient arm.

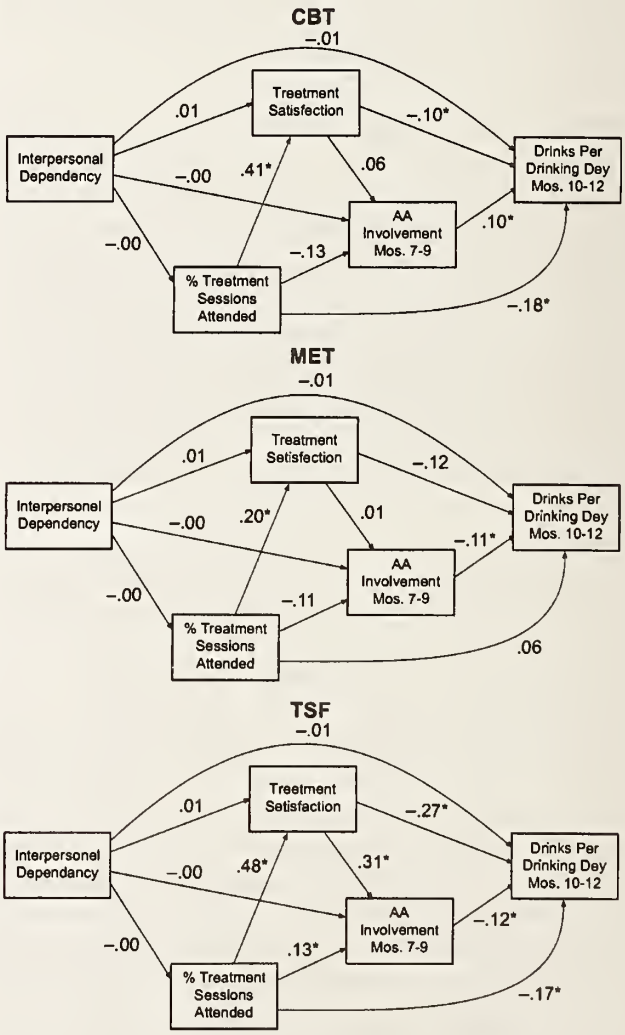

Figure 5. Multiple-group comparison of the causal model applied to drinks per drinking day in the outpatient arm.

showed no significant relationship with any other treatment or posttreatment variable in the model.

Aftercare Arm

Prognostic Effects of Interpersonal Dependency and the Interpersonal Dependency by Treatment Interaction

No significant effect of dependency on either outcome measure and no dependency by time interaction occurred in the aftercare arm (table 2). No significant or near significant interactions or individual contrast effects were observed.

The A Priori Causal Model

The multiple-group path analysis applied to the aftercare data also found the best fit in a partly constrained model for both PDA, χ^2= 14.66, df=12, n.s., and DDD, χ^2=18.7, df=12, n.s., respectively (figures 6 and 7). Sample *N*'s were 200, 191, and 170 for CBT, MET, and TSF, respectively. A pattern similar to that obtained in the outpatient arm was found. AA involvement during months 7–9 was significantly associated with a higher proportion of abstinent days in months 10–12. Attendance was positively associated with greater AA involvement in TSF but not in CBT or MET. Higher levels of satisfaction also were associated with more AA involvement in TSF but not CBT or MET. Finally, unlike the outpatient arm, and contrary to predictions, interpersonal dependency was positively associated with AA involvement in the CBT condition but not in TSF or MET.

Discussion

We found no support for the hypothesis that interpersonal dependency interacts with treatment type to influence outcome. Some partial, yet very weak, support was obtained in the outpatient arm for the prediction that individuals high in interpersonal dependency would benefit less in the MET condition. However, this finding only applied to differences between CBT and MET and not TSF. In the long-term followup, we also found support for the notion that individuals high in interpersonal dependency benefited from either of the more intense treatments (i.e., CBT and TSF) relative to low-intensity treatment (i.e., MET). Given that the full interaction term either only approached significance or met uncorrected criteria in each case, we conclude that interpersonal dependency alone holds little clinical value as a variable for triaging clients to either CBT, MET, or TSF.

Results of the causal models were clear in demonstrating that interpersonal dependency had no direct or indirect effect on outcome

Table 2. Interpersonal Dependency—Aftercare

Treatment contrast		Within treatment						Posttreatment					
		MV × Tx		MV × Tx × T		MV ×Tx × T^2		MV × Tx		MV × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	*F*	.23	-.37	.25	-.90	-.51	.07	.87	-.62	-.72	.75	-.21	-.45
	p	.81	.71	.80	.37	.61	.94	.38	.53	.47	.45	.84	.65
CBT–TSF	*F*	1.53	-1.19	-.05	-.58	-1.39	.78	1.65	-1.51	.03	1.37	-.84	.27
	p	.13	.23	.96	.56	.16	.44	.10	.13	.98	.17	.40	.79
MET–TSF	*F*	1.31	-.85	-.28	.26	-.92	.72	.80	- .91	.72	.64	-.63	.69
	p	.19	.39	.78	.80	.36	.47	.42	.37	.47	.53	.53	.49
MV × Tx	*F*	1.32	.74	.05	.42	.98	.36	1.37	1.15	.35	.94	.38	.25
	p	.27	.48	.95	.66	.38	.70	.25	.32	.71	.39	.69	.78

MV = matching variable, Interpersonal Dependency; Tx = treatment; T = linear time; T^2 = quadratic time; PDA = percentage of days abstinent; DDD = drinks per drinking day

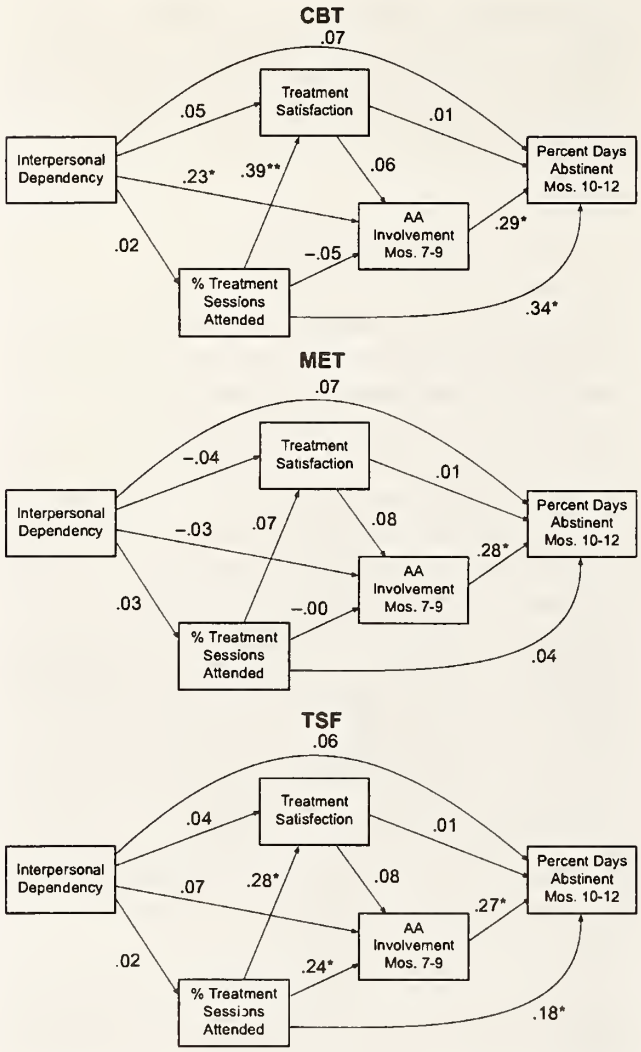

Figure 6. Multiple-group comparison of the causal model applied to percentage of days abstinent in the aftercare arm.

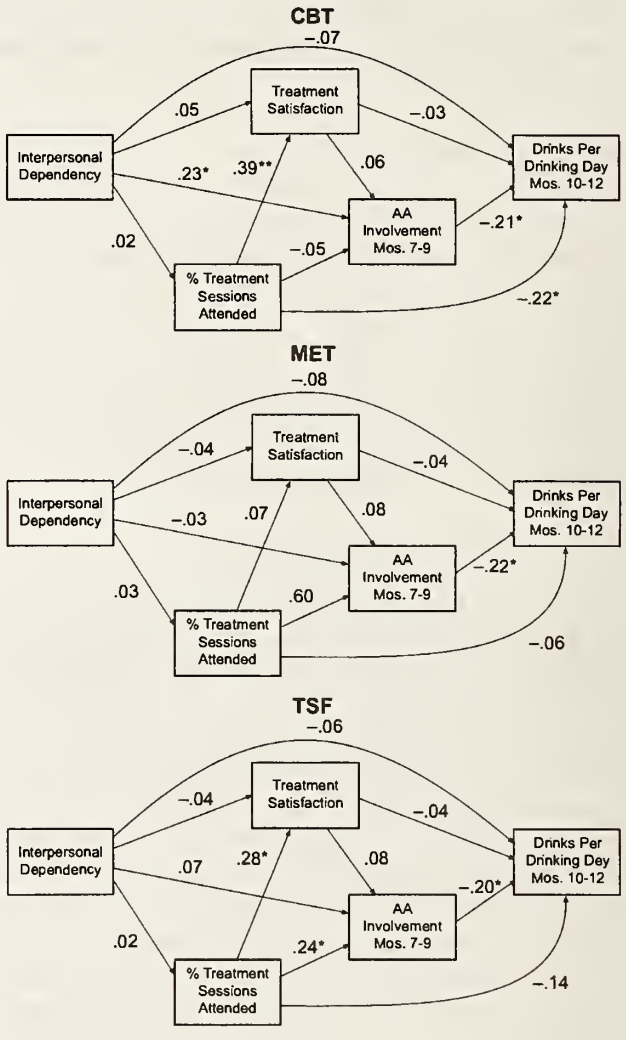

Figure 7. Multiple-group comparison of the causal model applied to drinks per drinking day in the aftercare arm.

among outpatients regardless of treatment type received. Only in the aftercare arm did dependency show a significant positive indirect effect on outcome through its positive direct association with AA involvement, and then only among CBT participants. Why this effect was found only in CBT is not clear. Perhaps the combination of a period of intense treatment (usually of a 12-step nature) followed by cognitive-behavioral treatment is an important factor in facilitating continued involvement in AA. The exact mechanisms of such a model, however, remain to be elucidated.

Some additional cautions regarding the current results must be made. First, we used only the Assertion of Autonomy Scale of the IDI (with reverse scoring) for our interpersonal dependency measure. It may be that use of other measures of dependency would yield different results. Also, it is perhaps not surprising that a measure of interpersonal dependency by itself would provide little value in client-treatment matching. Human behavior is so complex that only when interpersonal dependency is evaluated within higher order interactions with other variables (e.g., motivation, family functioning,

alcohol involvement) could its role on outcome be detected. In fact, the work of McKay and associates (1992, 1993) would appear to support this notion. Further exploratory analyses of the MATCH data set may help to explain such pathways.

In sum, interpersonal dependency was not found to interact with treatment type to influence outcome. While AA involvement was found to influence outcome, the hypothesized role of interpersonal dependency in mediating this relationship was not found. Research, with alternate dependency measures, that examines dependency in combination with other prognostic variables may further understanding in this area.

Acknowledgment

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The Gender Matching Hypothesis

Frances K. Del Boca, Ph.D., and Margaret E. Mattson, Ph.D.

ABSTRACT

This chapter evaluates the gender matching hypothesis in Project MATCH, which states that women will benefit more from Cognitive-Behavioral Coping Skills Therapy (CBT) than from Twelve Step Facilitation (TSF) and that the differential outcomes for the two treatments will be greater for female clients than for males. CBT was expected to address the ancillary problems (e.g., external stressors, negative mood) that are more prevalent among female alcoholics; at the same time, TSF, which would encourage women to attend Alcoholics Anonymous (AA) meetings, was expected to increase guilt and undermine self-esteem and assertion. Tests of the matching contrasts failed to provide support for the hypothesis in either arm of the trial. Gender did produce significant prognostic effects in analyses of the aftercare arm, with women reporting a higher proportion of abstinent days and fewer drinks per occasion than men did. Causal chain analyses produced mixed results. Male and female clients were shown to differ in terms of their initial treatment needs, and followup status with respect to these needs was related to drinking outcomes. Contrary to prediction, however, CBT sessions for women, as compared with those for men, were not appreciably more likely to teach general problem-solving or mood-management skills. Further, women did not avoid AA meetings. Attendance at self-help meetings was comparable for the sexes in the outpatient arm; in the aftercare study, women attended significantly more meetings and reported a higher degree of AA involvement.

Until recently, relatively few empirical studies have directly compared outcomes for alcoholic men and women in differing treatments (McCrady and Raytek 1993). Nevertheless, clinicians strongly recommend gender-specific approaches to the treatment of alcohol and other substance abuse problems. The literature is replete with reports contrasting male and female alcoholics along dimensions that are purported to have relevance for the delivery of treatment (cf. Del Boca 1994). Further, gender has often been implicated in alcoholism typologies, with the implicit or explicit suggestion that the etiology and course of alcoholism differ for the two sexes (cf. Del Boca and Hesselbrock 1996). The factors that contribute to gender differences are sometimes presumed to be fundamentally biological or genetic in origin; more often, however, the sources of gender-related variations are not fully articulated. Rather, gender is regarded as a surrogate for a variety of genetic factors (e.g., biological sex) and sociocultural influences (e.g., gender-role prescriptions) that differentiate members of our two most important and recognizable social categories. This perspective is adopted in the present formulation.

The Hypothesized Matching Contrast

It is hypothesized that females will experience more favorable outcomes in Cognitive-

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Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992) than in Twelve Step Facilitation (TSF; Nowinski et al. 1992) in Project MATCH and that this differential will be significantly larger for females than for males. No prediction is made about the direction of the difference between the two treatment modalities for males. A significant main effect for client sex, with women showing better outcomes than men, would be consistent with the literature. However, the gender hypothesis formulation for Project MATCH includes no prediction regarding gender main effects. The gender matching hypothesis may be represented as follows:

Females	Males
[(CBT – TSF) > 0]	> > (CBT – TSF)

Rationale for the Matching Hypothesis

Although there is little directly relevant research evidence for matching treatment to gender, there is considerable indirect empirical support in addition to theoretical justification.

Empirical Evidence

Major reviews of the treatment outcome literature on alcoholic women agree that there is limited research evidence regarding the differential effectiveness of various therapeutic modalities or treatment components (e.g., Vannicelli 1984; Institute of Medicine 1990; Lex 1990). Without differentiating among treatments, reviewers conclude, however, that female alcoholics benefit from treatment despite their greater concomitant psychological, social, and medical problems, and some studies report that they fare better at followup than their male counterparts (cf. Jarvis 1992; Vannicelli 1984; Vannicelli and Nash 1984; Annis and Liben 1980).

The limited research that has examined treatment outcomes for alcoholic women tends to be consistent with the matching hypothesis framed above. It should be emphasized, however, that this research has relied on uncontrolled studies that usually involve treatments that differ somewhat from those used in Project MATCH. For example, Lyons and associates (1982) examined treatment outcomes for 1,340 clients from 17 alcoholism treatment programs in New York State. Programs were classified as having one of three different treatment orientations: peer group, rehabilitation, or medical. Alcoholic men achieved the most favorable outcomes when treated in programs with a peer-group orientation (similar to Alcoholics Anonymous); programs with rehabilitation and medical orientations reported comparable success rates, not far below those with a peer-group approach. In contrast, female clients fared best in medically oriented programs; the least improvement was observed for treatments with a peer-group orientation.

Similarly, female clients who received a gender-specific treatment in a random assignment study in Sweden achieved superior outcomes compared with women in conventional therapy (Dahlgren and Willander 1989). The authors concluded that women in the latter group were unwilling to be confronted by male clients, a likely circumstance in traditional 12-step programs.

In an attempt to examine factors that may contribute to differential outcomes for women and for men in alcoholism treatment, Jarvis (1992) analyzed 20 treatment outcome studies using meta-analytic techniques. Although the studies varied along many dimensions, Jarvis concluded that those showing a male advantage in terms of outcome more often involved "inpatient programmes incorporating psychotherapy, milieu therapy and Alcoholics Anonymous" (p. 1253). In contrast, according to Jarvis, alcoholic women tended to fare better in behavioral treatments.

Alcoholic women tend to have specific material needs and psychological problems that might be best addressed with particular treatment programs. Documented differences between female and male alcoholics that are pertinent to the treatment matching hypothesis can be summarized in terms of four interrelated domains:

- External stressors and negative mood
- Role demands
- Psychopathology and emotional problems
- Self-esteem and instrumentality

External Stressors and Negative Mood

Although some studies do not support the notion that women consume alcohol in response to stressful or traumatic events (Morrissey and Schuckit 1978; Cooke and Allan 1984), research has consistently found that women *attribute* their drinking to external stressors and negative mood states more often than do men (e.g., Morrissey and Schuckit 1978; cf. Lex 1990; Del Boca 1994). Compared with men, female alcoholics who seek treatment are more often unemployed and beneficiaries of public assistance. Data from panel surveys indicate that women drink to cope with difficult life events, especially reproductive problems (Wilsnak et al. 1986) and that they are more likely to do so than men (Institute of Medicine 1990). Such findings have led reviewers to argue that treatments that teach coping skills and relapse prevention techniques, such as cognitive-behavioral approaches, should be particularly effective for women (e.g., Lex 1990; Institute of Medicine 1990).

Role Demands

Alcoholic women often report having more childcare responsibilities and family problems than alcoholic men, and they are more likely than men to seek treatment specifically for marital problems, family disruption, physical illness, or emotional difficulties (e.g., Marsh and Miller 1985; Duckert 1987; Ginther and Kadden 1990). Such problems are frequently related to alcohol consumption but often are not acknowledged as such (Beckman 1984; McCrady and Raytek 1993), possibly because of the greater social stigma associated with alcoholism in females (Gomberg 1988). In addition to teaching women methods for resisting alcohol use, the cognitive-behavioral approach is likely to provide coping skills that will generalize to other difficult situations. Further, CBT, if successful, should challenge and alter maladaptive cognitions regarding alcohol use.

Psychopathology and Emotional Problems

Several studies have found that female alcoholics experience higher rates of psychiatric disorders, particularly affective disorders, than women in general. Diagnoses of depression and anxiety disorders are significantly more prevalent among female than among male alcoholics, who are more likely to evidence antisocial personality (ASP) disorder (Hesselbrock and Hesselbrock 1993). CBT, with its emphasis on the cognitive restructuring of perception, is likely to be most effective in helping women to overcome depression and anxiety. Further, because CBT teaches methods for managing stressful situations, women may be less likely to become involved in circumstances that contribute to depression and anxiety and that ultimately lead to drinking. CBT is also expected to be beneficial to alcoholic men with psychiatric problems. Male alcoholics high in sociopathy have been found to respond better to CBT than to other approaches (Kadden et al. 1989). Thus, the higher prevalence of ASP among alcoholic men suggests a possible advantage for CBT in Project MATCH.

Self-Esteem and Instrumentality

Many reviewers have noted that alcoholic women lack self-esteem and assertiveness. Female alcoholics are frequently characterized as passive, dependent, and low in self-efficacy (e.g., Beckman 1978). These attributes are often used to explain the tendency for women to be influenced by alcoholic or substance abusing significant others (Hser et al. 1987). As a consequence, several authors have recommended that the treatment of female clients include assertiveness training (e.g., Beschner et al. 1981; Institute of Medicine 1990; Lex 1990). As implemented in Project MATCH, an important goal of CBT treatment is to enhance self-efficacy and promote independent decision-making. The successful management of affect, cognition, and behavior over time, coupled with the effective application of coping strategies, particularly refusal skills, should serve to enhance self-esteem, increase feelings of self-efficacy, and promote instrumentality.

Theoretical Justification

In addition to alcohol and substance abuse research, several other lines of investigation

converge in support of the gender matching hypothesis. These include research and theory in the more general areas of sex differences and gender roles, and studies of the actual behavior of men and women in groups.

Factors which differentiate male and female alcoholics also tend to differentiate the sexes more generally. That is, nonalcoholic women differ from nonalcoholic men in terms of material resources, the prevalence of affective disorders and sociopathy, and other characteristics that distinguish their alcoholic counterparts (Hilton 1987, 1988). These and other sex differences can be summarized in terms of two salient features of traditional gender roles (Gilligan 1977):

- Females typically have less power than males, resulting in less control over resources and outcomes, with concomitant low self-efficacy and negative affect.
- Women evidence a greater concern for, and assume more responsibility for, the quality of interpersonal relationships.

In sum, by virtue of their socialization, social position, and sex stereotypic expectations, women are more likely than men to lack self-worth and instrumentality, to experience depression and anxiety, and to drink in response to stress and negative mood states. Because of their heightened sense of personal responsibility, and because of the greater social disapproval of female drinking, alcoholic women are also more likely to exhibit guilt and worry regarding the impact of their alcohol use.

Expressive and communal are terms used to characterize the psychological orientation associated with the emphasis on connection, feelings, and interpersonal relationships in the traditional female role; instrumental and agenic are used to summarize the self-assertive, autonomous, and controlling attributes that are central to the conventional male role (e.g., Block 1973; Spence 1985). Although the traditional feminine emphasis on interpersonal responsibility may contribute to the array of problems that alcoholic women present in treatment, lack of instrumentality is likely to be more problematic. In more general research on sex differences, high instrumentality has been found to be a strong predictor of self-esteem and psychological adjustment (e.g., Taylor and Hall 1982).

CBT is expected to be the most effective of the Project MATCH treatments for women because it directly addresses the problem areas characteristic of alcoholic women. In terms of gender-role orientation, CBT enhances the development of instrumentality and self-efficacy. Furthermore, it is the only Project MATCH therapy with active ingredients that effectively address problems other than drinking per se (negative affect, psychopathology, poor coping skills). Thus, CBT is the only treatment designed to deal specifically with those factors that differentiate alcoholic women and men, factors that are likely to contribute to female alcohol use prior to treatment and precipitate relapse following periods of sobriety.

Compared with CBT, TSF is hypothesized to be less effective for female clients for three reasons. First, although delivered individually in Project MATCH, a major aim of TSF is to involve clients in Alcoholics Anonymous (AA) and to encourage them to attend AA meetings. Because women are more socially stigmatized for heavy drinking, they more often drink alone. As a consequence, it has been argued that women prefer, and derive more benefit from, individual treatment, because the experience of social disapproval can be minimized (Jarvis 1992; Cronkite and Moos 1984). The confrontational style of many AA groups may exacerbate guilt feelings related to drinking without providing the coping skills necessary to deal effectively with negative mood states.

Second, the confrontational behavior characteristic of many AA meetings is incongruent with the traditional female role, which prescribes noncombative, conciliatory behavior for women. There is considerable research indicating that men are more dominant in mixed-sex groups than women, that they simply talk and interrupt more often, and that they are more likely to assume leadership roles (Bartol and Martin 1986). These tendencies are especially marked in groups with a preponderance of males. Since alcoholism is more prevalent among males than females, men in AA groups

are likely to outnumber women by a significant margin, which may discourage women from active participation.

Third, TSF is expected to be less effective than CBT because it fails to deal with problems relating to self-esteem and instrumentality. Because AA participants are urged to accept their powerlessness over alcohol and to put their faith in a higher power, this approach may tend to undermine, rather than promote, the development of instrumentality and a sense of self-worth.

In contrast to female clients, there are reasons to argue that alcoholic men will respond favorably to both CBT and TSF. As with their female counterparts, there is considerable heterogeneity within this population. Some males will evidence the same types of problems as have been described for females, and these men are expected to fare well in CBT. In addition, more positive outcomes for CBT clients high in sociopathy have been observed in prior treatment-matching research (Kadden et al. 1989), although this study employed group rather than individual therapy.

Twelve-step approaches also appear to benefit alcoholic men, particularly when participation occurs in groups (e.g., Cronkite and Moos 1984). It has been suggested that male clients benefit from group therapy because men, unlike women, tend to drink in groups. Heavy alcohol consumption in group settings is not only socially approved for men but is also quite consistent with gender-role expectations. Alcohol may serve a social function for men, and the camaraderie often associated with male drinking may find a substitute in group settings such as AA (Jarvis 1992). Because TSF is delivered as individual therapy in Project MATCH, it is anticipated that the positive outcomes experienced for TSF men will depend on the extent to which participants attend AA meetings as an adjunct to Project MATCH treatment.

Operationalization of the Matching Variable

Because gender is correlated with a variety of attributes that are related to treatment need, it might be argued that each of these other attributes offers an alternative explanation for any Gender × Treatment condition interactions obtained in Project MATCH. Conversely, it is suggested here that *gender effectively summarizes* a variety of interconnected individual difference factors that are related to drinking and differentially related to treatment response. More importantly, most of these differences arise in large part from individual and social expectations that are fundamentally based on gender (cf. Del Boca and Ashmore 1986). Thus, gender is an appropriate variable for use in matching clients to alcoholism treatment.

Gender was operationalized in terms of the client's self-identification as a male or female. The outpatient sample included 688 males and 264 females; participants in the aftercare arm were 619 men and 155 women. Thus, the majority of clients in both arms of the trial were male (72.3 percent in outpatient and 80 percent in aftercare). Specific sites varied in terms of their relative proportions of men and women, ranging from 10.8 percent females in one aftercare site to 35.4 percent in one outpatient site.

Only those clients assigned to the CBT and TSF treatment conditions were included in testing the hypothesis. This resulted in an outpatient sample of 453 men (217 in CBT, 236 in TSF) and 183 women (84 in CBT, 99 in TSF) and an aftercare sample of 405 males (202 in CBT, 203 in TSF) and 108 females (64 in CBT and 44 in TSF). Clients assigned to Motivational Enhancement Therapy (Miller et al. 1992) are reported for completeness.

Results

Matching and Prognostic Effects

Outpatient Arm

Table 1 presents a summary of the results of the latent growth curve analyses used to test the gender matching hypothesis. As shown, the hypothesis was not supported for either the 12-week treatment phase or the 1-year posttreatment followup period. This finding was consistent across the two primary outcome variables

Table 1. Gender effects—Outpatient arm

Treatment contrast		Within treatment						Posttreatment					
		MV × Tx		MV × Tx × T		MV × Tx × T^2		MV × Tx		MV × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	*t*	-1.13	.91	-.64	-.23	.79	-.28	.00	.44	-.16	-.05	-1.23	.07
	p	.26	.36	.52	.82	.43	.78	.99	.66	.87	.96	.22	.95
CBT–TSF	*t*	-1.97	1.46	.00	-.72	.70	-.31	-.73	1.14	1.27	1.48	-.34	-.30
	p	**.05**	.14	.99	.47	.48	.76	.46	.25	.20	.14	.73	.76
MET–TSF	*t*	-.84	.55	.69	-.50	-.11	-.02	-.74	.69	1.45	1.44	.95	-.38
	p	.40	.59	.49	.61	.91	.99	.46	.49	.15	.15	.34	.71
MV × TX	*F*	1.94	1.08	.29	.28	.36	.06	.37	.67	1.29	1.47	.83	.08
	p	.14	.34	.74	.75	.70	.94	.69	.51	.28	.23	.44	.92

MV=matching variable, Gender; Tx=treatment; T=time; T^2 =quadratic time; PDA=percentage of days abstinent; DDD=drinks per drinking day; CBT=Cognitive-Behavioral Coping Skills Therapy; MET=Motivational Enhancement Therapy; TSF=Twelve Step Facilitation

NOTE: All *p* values are nondirectional and should be halved to determine *p* values for a directional test.

in Project MATCH, percentage of days abstinent (PDA) and drinks per drinking day (DDD). Further, gender was not a significant predictor of drinking outcomes during either the 12-week treatment phase or the posttreatment period (Project MATCH Research Group 1997, 1998*a*).

The gender matching hypothesis was tested in the outpatient arm at the 3-year followup point. Again, there was no evidence to support the hypothesis nor was there a simple prognostic effect for either of the two primary outcome measures (Project MATCH Research Group 1998*b*).

Aftercare Arm

The results of tests of the gender matching hypothesis for the aftercare arm are presented in table 2. The hypothesis was not confirmed for either of the two timeframes examined (within treatment and posttreatment) in analyses of either dependent measure.

Gender did, however, have a significant but small prognostic effect on outcome, with aftercare women reporting higher proportions of abstinent days (p=.004) and fewer drinks per occasion (p=.038) than men, and the DDD effect became more pronounced over time (p=.017) (Project MATCH Research Group 1997).

The A Priori Causal Chain

Figure 1 is a schematic representation of the causal chain that underlies the gender matching hypothesis. This depiction follows the rationale presented above. Gender is associated with treatment needs that are believed to be more effectively addressed by CBT than by TSF. As suggested by prior research, female alcoholics are likely to experience more ancillary problems than males as well as guilt and anxiety in relation to drinking (external stressors/negative mood), to assume greater responsibility in spousal and parental roles (role demands), and to evidence higher levels of anxiety and depression (psychopathology/emotional problems). At the same time, they may be less able to cope with their problems as a result of low self-worth and self-assertion (self-esteem/instrumentality). Three specific aspects of CBT (that are missing in TSF) are thought to address these factors—skills training, mood management, and assertiveness training. The philosophy of AA and the confrontational style of AA meetings may impede recovery. Female clients are expected to improve differentially on intervening outcome measures (skill acquisition, improved role performance, reduction in psychopathology,

Table 2. Gender effects—Aftercare arm

Treatment contrast		Within treatment						Posttreatment					
		MV × Tx		MV × Tx × T		MV × Tx × T^2		MV × Tx		MV × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	*t*	−.32	.03	−.47	−.01	−1.49	1.39	.08	−.15	−.73	.59	.31	.21
	p	.75	.98	.64	.99	.14	.16	.94	.88	.46	.56	.75	.83
CBT–TSF	*t*	−1.79	1.52	−1.41	.53	1.00	−.92	.42	.42	.84	.98	−.20	−.51
	p	.07	.13	.16	.60	.32	.36	.68	.67	.40	.33	.84	.61.
MET–TSF	*t*	−1.33	1.35	−.85	.49	2.30	2.13	.45	.53	1.45	−.34	−.47	−.66
	p	.19	.18	.40	.62	**.02**	**.03**	.65	.60	.14	.73	.64	.51
MV × Tx	*F*	1.70	1.36	1.00	.17	2.66	2.29	.12	.15	1.06	.50	.11	.24
	p	.18	.26	.37	.84	.07	.10	.88	.86	.35	.61	.89	.79

MV = matching variable, Gender; Tx = treatment; T = time; T^2 = quadratic time; PDA = percentage of days abstinent; DDD = drinks per drinking day; CBT = Cognitive-Behavioral Coping Skills Therapy; MET = Motivational Enhancement Therapy; TSF = Twelve Step Facilitation

NOTE: All *p* values are nondirectional and should be halved to determine *p* values for a directional test.

and improved self-efficacy) in response to these therapy factors which, in turn, are hypothesized to affect both the frequency and quantity of alcohol consumption.

Although the model depicted in figure 1 contains many components, it is a relative simplification of the processes that underlie the gender matching hypothesis. The cluster of characteristics that differentiate female from male alcoholics in the hypothesized model tend to be interrelated, and their relationships to drinking and alcohol-related problems comprise a complex network of direct and indirect pathways. For example, stressful life events may contribute *directly* to alcohol use in females and *indirectly* to consumption through their impact on negative affective states, which also influence alcohol use. Drinking, in turn, tends to produce

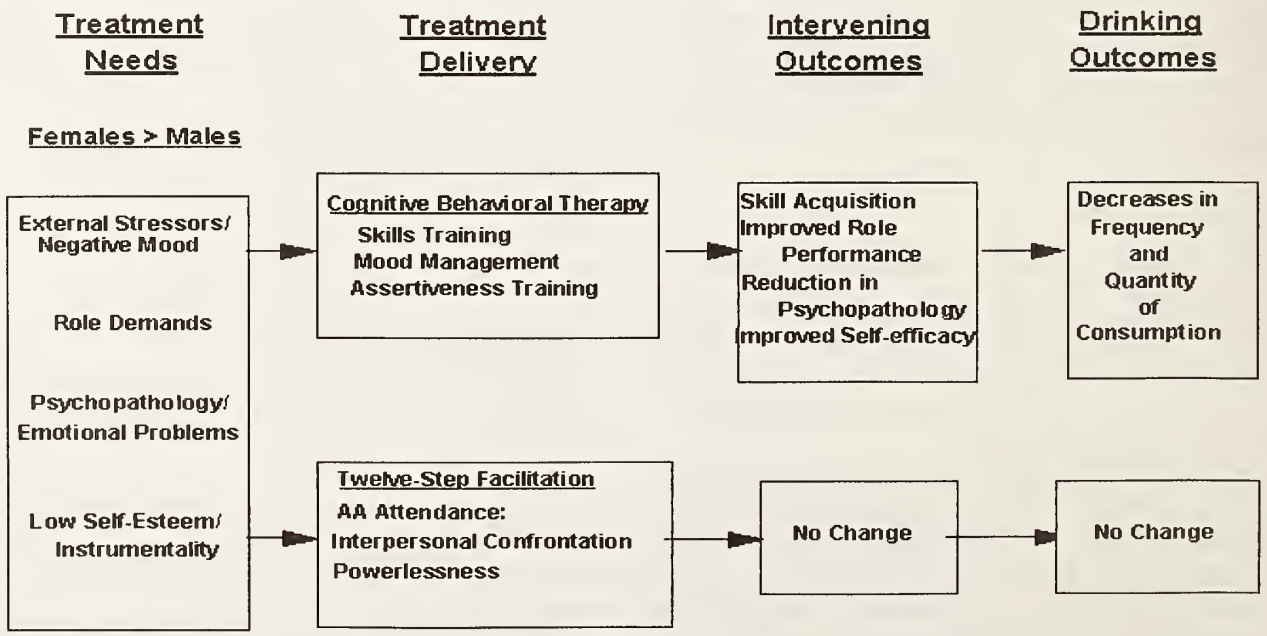

Figure 1. Gender treatment matching hypothesis causal chain.

problems that create stress and aggravate feelings of depression and anxiety. The active ingredients in CBT *collectively* influence the relevant intervening variables, which, in turn, result in decreased alcohol consumption.

Testing the Causal Chain

The causal chain outlined above involves four testable predictions, each of which may be phrased as a question:

- Are the hypothesized gender differences in treatment needs present at baseline?
- Did CBT and TSF treatment delivery differ as anticipated?
- Did the two treatments differentially affect the intervening variables as predicted?
- Are the intervening variables related to drinking outcomes?

Each question is examined in turn for the two arms of the trial.

Outpatient Arm

Are hypothesized baseline gender differences present? That is, did male and female clients in Project MATCH differ significantly in terms of treatment needs? To test this component of the causal chain, the sexes were compared on a variety of specific indicators that reflect the four domains specified in figure 1. Because the assessment battery was not designed specifically for this purpose, it was necessary to examine responses to individual items within questionnaires to operationalize these domains, in addition to examining scores on standardized measures. The results of t-tests comparing outpatient men and women on scale scores are summarized in table 3.

The Project MATCH assessment battery did not include a comprehensive measure of stressful life circumstances. However, two sets of items, one from the trial's screening questionnaire, the other from the Addiction Severity Index (ASI; McLellan et al. 1992), provide evidence of differential economic hardship and stressful life experiences. Females were significantly less likely to be employed than males (38 versus 58 percent), and they were also significantly more likely to report a history of physical or sexual abuse (60 versus 37 percent). Within the same domain, three scales from the Alcohol Use Inventory (AUI; Wanberg et al. 1977) assessed drinking in relation to negative mood states: Anxious Concern About Drinking, Drink to Manage Mood, and Guilt and Worry Associated With Drinking. Outpatient women consistently reported more negative affect associated with drinking than did men; significant differences were obtained for all three relevant AUI scales.

The results were mixed for the Role Demands domain. In terms of item indicators, female clients reported more childcare responsibilities than did their male counterparts (37 versus 32 percent), and they were less likely than men to report living with a spouse (26 versus 32 percent). Neither difference, however, was statistically significant. There were also no gender differences on the Social Role Performance scale of the Psychosocial Functioning Inventory (Feragne et al. 1983). On the other hand, females in the outpatient study reported receiving significantly less Family Social Support, and they were significantly more likely than men to attribute their alcohol use to marital difficulties on the AUI scale, Drink to Deal With Marital Problems.

Results were more consistent with predictions in the Psychopathology/Emotional Problems domain. As indicated in prior research, affective disorders were more prevalent among females than males, whereas men were more likely to receive an ASP diagnosis. Women also scored significantly higher on the ASI Psychiatric Severity scale and on the Beck Depression Inventory (BDI; Beck et al. 1961).

Although no measure of self-esteem per se was included in the assessment battery, gender differences on instruments reflecting self-esteem/instrumentality were all consistent with expectations. Women scored lower than men in instrumentality ("masculinity") on the Personal Attributes Questionnaire (PAQ; Spence et al. 1974) and higher on expressiveness ("femininity") as well as on the Assertion of Autonomy scale of the Interpersonal Dependency Inventory (Hirschfeld et al. 1977). In addition, they

Table 3. Baseline gender differences in treatment need domains by study arm—Mean (SD)

Intake variable	Outpatient arm			Aftercare arm		
	Males	Females	*p*	Males	Females	*p*
External stressors/negative mood						
Anxious Concern About Drinking (AUI)	13.1 (4.9)	15.0 (4.7)	.000	14.9 (4.6)	15.9 (4.5)	.026
Drink to Manage Mood (AUI)	4.9 (2.3)	5.7 (2.1)	.000	5.5 (2.1)	6.0 (1.8)	.015
Guilt and Worry Associated With Drinking (AUI)	5.6 (2.3)	6.1 (2.1)	.001	6.3 (2.2)	6.5 (2.1)	.454
Role demands						
Social Role Performance (PFI)	3.5 (.77)	3.5 (.79)	.278	3.3 (.93)	3.3 (.88)	.452
Family Social Support	4.3 (2.3)	3.6 (2.6)	.000	4.2 (2.4)	4.2 (2.5)	.407
Drink to Deal with Marital Problems (AUI)	1.9 (2.0)	2.6 (2.2)	.003	2.2 (2.0)	3.0 (2.2)	.005
Psychopathology/emotional problems						
Psychiatric Severity Scale (ASI)	.19 (.19)	.22 (.20)	.052	.21 (.20)	.32 (.24)	.000
Beck Depression Inventory	9.3 (7.7)	11.6 (8.8)	.001	10.2 (8.1)	12.4 (10.0)	.013
Self-esteem/instrumentality						
Instrumentality (MASC–PAQ)	28.4 (5.1)	26.1 (5.4)	.000	27.9 (5.3)	24.6 (5.4)	.000
Expressiveness (FEM–PAQ)	30.0 (4.5)	32.1 (4.3)	.000	29.9 (5.0)	32.6 (4.6)	.000
Masculinity-Feminity (PAQ)	24.7 (3.8)	27.7 (4.5)	.000	25.2 (4.0)	29.4 (3.7)	.000
Alcohol Self-Efficacy	3.0 (.81)	2.8 (.76)	.036	3.2 (1.0)	3.2 (1.0)	.366
Interpersonal Dependency	40.4 (7.0)	41.9 (6.9)	.005	40.4 (7.0)	43.2 (7.6)	.000

NOTE: AUI=Alcohol Use Inventory; ASI=Addiction Severity Index; PAQ=Personal Attributes Questionnaire; PFI= Psychosocial Functioning Inventory. One-tailed t-tests were used to test for between-group differences.

reported significantly lower levels of alcohol self-efficacy (DiClemente et al. 1994).

In summary, significant gender differences were obtained for 17 of 20 intake assessment variables that span 4 relevant treatment need domains. These differences indicate that the treatment needs of outpatient women tended to differ from those of male clients, and they provide confirmation for the first prediction derived from the gender matching hypothesis causal chain.

Did CBT and TSF treatment delivery differ as anticipated? The Project MATCH therapies have been shown to be discriminable in terms of critical ingredients (Carroll et al. 1998). For purposes of investigating the causal chain, however, it is also important to show that males and females received sufficient exposure to the two treatments and that the specific elements hypothesized to affect outcomes were present in CBT and TSF. To begin to address this issue, session attendance rates within the two treatments were compared in a 2 (Gender) × 2 (Treatment condition) ANOVA. No significant main effects were found, and there were no sex differences in session attendance rates as a function of treatment assignment. On average, outpatient CBT males attended 8.28 therapy meetings and females completed 8.25 sessions; comparable values for TSF were 7.49 and 7.46.

Next, exposure to particular treatment elements was examined. In terms of CBT, sex differences in the session content (as recorded by the therapist) of each CBT session were examined. Two types of measures were evaluated: (1) session topics and (2) therapist ratings of the degree to which the sessions emphasized problem-solving and coping skills. Session topics were considered separately for core and elective

therapy sessions. The former focus more specifically on drinking (e.g., drink-refusal skills) and were intended for all CBT participants, whereas the elective sessions were designed to cover problems that were of particular relevance to individual clients (e.g., anger management).

The second type of measure, therapist session ratings, was designed to assess the type of activity that took place, independent of the specific topic (e.g., apply a problem-solving strategy). It should be noted that, although these treatment process data provide important clues as to what occurred in therapy, there is considerable missing data on these measures, with the analyses at week 12 examining only 25 percent of the outpatient sample. (Consistent with the treatment attendance data, the relative proportions of males and females approximate those for the outpatient sample more generally across the various sessions.) In addition, the responses represent only the therapists' (and not the clients') perceptions.

Table 4 indicates, for treatment sessions #2 through #12, the extent to which the elements of CBT specified in the causal chain were primary topics in therapy. The first indicator, core sessions, sums across two topics—problem-solving and drink-refusal skills; the second indicator, elective sessions, includes three topics—introduction to assertiveness, managing negative thinking, and managing negative moods.

Overall, core therapy sessions accounted for 78 percent of the outpatient sessions included in table 4. Core therapy sessions pertinent to the causal chain occurred most often during relatively early sessions of treatment, specifically sessions #4 through #7. However, for a notable minority of men, these topics were covered in later sessions. Elective sessions dealing with assertiveness and negative thinking or moods tended to occur later in the treatment phase, and they were more prevalent for women clients.

In addition to a summary of session topics, table 4 presents mean therapist ratings of the

Table 4. CBT checklist therapist reports: Outpatient arm

	CBT session topics				Therapist session ratings	
	Core sessions: Problem-solving and drink-refusal skills (%)		Elective sessions: Assertiveness and mood management (%)		Problem-Solving and Coping-Skills Index Mean (SD)[a]	
Session (n)	Males	Females	Males	Females	Males	Females
2 (268)	2.6	.0	.5	.0	3.58 (.58)	3.73 (.54)
3 (256)	9.2	4.6	.0	.0	**3.55 (.60)**	**3.71 (.61)**
4 (234)	62.3	76.1	1.8	1.6	3.69 (.64)	3.82 (.65)
5 (223)	56.0	61.0	1.2	2.3	**3.52 (.71)**	**3.78 (.62)**
6 (219)	26.7	26.6	.7	6.7	3.52 (.72)	3.71 (.58)
7 (204)	15.7	21.4	1.4	1.8	3.50 (.68)	3.66 (.64)
8 (191)	5.3	15.1	12.1	14.2	3.42 (.75)	3.47 (.62)
9 (164)	8.4	2.0	16.0	22.0	3.37 (.75)	3.40 (.74)
10 (160)	6.3	.0	15.3	35.7	**3.30 (.70)**	**3.57 (.67)**
11 (133)	4.3	.0	16.2	24.3	3.33 (.77)	3.30 (.76)
12 (83)	.0	.0	1.6	.0	3.25 (.80)	3.06 (.87)

[a] The Problem-Solving and Coping-Skills index represents the mean rating using a response scale ranging from 1 ("not at all") to 5 ("extensively") across four items: (1) discussion of high-risk situations in terms of coping skills used; (2) therapist attempts to "teach, model, rehearse, review, or discuss specific skills"; (3) application of a problem-solving strategy; and (4) formulation of coping strategies to anticipate high-risk situations.

NOTE: Bold entries for therapist session ratings indicate significant gender differences, two-tailed t-test, $p < .05$.

extent to which problem-solving and coping skills were emphasized during the session. The index presented is based on four separate ratings:

- Discussion of high-risk situations in terms of coping skills used
- Therapist attempts to "teach, model, rehearse, review, or discuss specific skills"
- Application of a problem-solving strategy
- Formulation of coping strategies to anticipate high-risk situations

Ratings were made using a 5-point scale ranging from 1="not at all" to 5="extensively." Regardless of the specific session topic, therapists tended to report more emphasis on problem-solving/coping skills with female than with male clients, but the differences tended to be small and not statistically significant.

The patterns in table 4 suggest that CBT treatment delivery for both sexes involved the elements specified in figure 1. Moreover, these elements were more likely to be present for female than for male clients, presumably because of their greater relevance. However, the percentages in table 4 suggest that many women for whom data are available did not receive elective sessions dealing with the targeted issues. And, because the elective session topics were more often dealt with during the later weeks of treatment, many participants had ceased attending therapy (recall the mean number of sessions attended for both sexes was approximately eight). Therapist ratings present a similar picture. Problem-solving and coping skills were emphasized for clients of both sexes, and, in absolute terms, the ratings tend to average only somewhat above the midpoint of the 5-point rating scale. Thus, it is questionable whether female participants received adequate exposure to the critical ingredients of CBT specified by the hypothesis.

With respect to TSF, the gender matching hypothesis suggests that female clients may find AA meetings both uncomfortable and counterproductive in terms of their specific treatment needs. Table 5 presents a summary of male and female attendance rates at self-help meetings.

Table 5.—Gender differences in AA meeting attendance during the followup period

	Cognitive-Behavioral Therapy		Twelve Step Facilitation	
Time	Males	Females	Males	Females
Outpatient arm				
3 months	.04	.04	.21	.23
6 months	.05	.05	.13	.12
9 months	.05	.05	.11	.13
12 months	.06	.05	.10	.10
15 months	.07	.05	.10	.08
Aftercare arm				
3 months	.29	.26	.40	.43
6 months*	.21	.16	.25	.37
9 months*	.20	.13	.19	.32
12 months*	.17	.12	.18	.30
15 months*	.16	.11	.19	.40

NOTE: Cell entries represent the mean proportion of days that clients reported attending meetings during each followup time window as assessed via the Form 90 interview.
*t-tests indicate significant ($p < 0.05$, two-tailed) gender differences for those in the TSF condition at these time points.

This measure, derived from Form 90 (Miller 1996) interviews, represents the mean percentage of days within each 3-month followup period that meetings were attended. As shown, male and female clients reported comparable levels of meeting attendance. Both sexes were more likely to attend meetings in the TSF condition than in CBT. And, while attendance remained relatively stable in CBT, it tended to decline somewhat over time in TSF.

To assess differences in active participation in AA, female and male scores on the followup version of the Alcoholics Anonymous Involvement scale (Tonigan et al. 1996) were compared. No differences were found at any of the time points tested (3, 9, and 15 months following treatment initiation), suggesting that meeting-attendance rates do not mask underlying differences in involvement in AA.

Did the two treatments differentially affect the intervening variables? Is the gender matching hypothesis supported for those intervening outcomes that are differentially targeted by CBT and TSF? Four of the baseline measures used to establish sex differences at intake were repeated at 6-month intervals during the followup phase of the trial. Repeated-measures ANOVAs were performed using gender and treatment condition as between-clients factors and scores on the hypothesized intervening variables at baseline and 3-, 9-, and 15-month followup points as the dependent variables. The results of these analyses failed to support this set of linkages in the causal chain. In analyses of ASI Psychiatric Severity, the Beck Depression Inventory, Alcohol Self-Efficacy, and Social Role Performance, only one significant interaction involving gender and treatment assignment was obtained, and this result was inconsistent with the predicted effect. A significant Gender × Treatment condition × Time interaction was found for Psychiatric Severity (F=4.07, df= 3,1218, p=.007). As shown in table 6, during the followup period (and particularly toward the end of the period), TSF women reported fewer psychiatric symptoms on the ASI, and greater reductions from baseline levels, than those assigned to CBT, whereas changes for males were comparable across the two treatments.

Table 6.—ASI Psychiatric Severity Scale Gender × Treatment interaction effect: Outpatient sample — Mean (SD)

Time	Cognitive-Behavioral Therapy		Twelve Step Facilitation	
	Males (n=168)	Females (n=74)	Males (n=183)	Females (n=79)
Baseline	.20	.23	.19	.21
	(.20)	(.21)	(.19)	(.20)
3 months	.14	.17	.12	.14
	(.17)	(.21)	(.17)	(.17)
9 months	.13	.15	.11	.13
	(.18)	(.21)	(.16)	(.16)
15 months	.09	.18	.09	.11
	(.16)	(.22)	(.15)	(.16)

Gender × Time: F=2.82; df=3,404; p=.039.
Gender × Treatment Assignment × Time: F=4.07; df=3, 1218; p=.007.

Are the intervening variables related to drinking outcomes? Table 7 presents correlations between the intervening variable indicators and drinking measures at the end of treatment and 1 year later. Despite the considerable variation in the strength of the relationships (r's ranging from 0.01 to 0.51), all of the correlations are in the expected direction. Correlations involving the ASI tend to be weak and nonsignificant; relationships between BDI and Social Role Performance scores and drinking are larger. Not surprisingly, associations are strongest for the Alcohol Self-Efficacy scale, which is most directly related to drinking. On average, the entries in table 7 are higher for female than for male clients. Thus, although not completely consistent across measures, intervening outcome variables tend to be correlated with alcohol consumption indicators during the followup period.

In summary, causal chain analyses for the outpatient sample produced mixed results. Gender differences were found in terms of the treatment needs specified in the model, and scores on the intervening variables were correlated with drinking outcomes. However, indicators of treatment process suggested that CBT and TSF may not have been delivered and experienced as anticipated. Although more emphasis was given to general coping skills and mood management for female clients in CBT than for males, the magnitude of the difference was relatively small, and the amount of attention paid to these areas was somewhat limited. In terms of TSF, men did not attend AA meetings more often than women, and they did not evidence higher levels of AA involvement. Further, only one significant Gender × Treatment condition interaction effect was observed for the intervening outcome variables that were the direct targets of the treatments in the causal chain, and the pattern of results was opposite that predicted.

Aftercare Arm

Are hypothesized baseline gender differences present? As described above, male and female clients were compared in terms of a variety of measures of treatment need. As in the outpatient study, aftercare women were significantly

Table 7.—Correlations between hypothesized intervening variables and drinking outcomes

Variables	Males				Females			
	PDA^4	PDA^{15}	DDD^4	DDD^{15}	PDA^4	PDA^{15}	DDD^4	DDD^{15}
Outpatient arm								
Social Role Performance	.20	.20	-.22	-.28	.26	.21	-.36	-.25
ASI Psychiatric Severity	-.08	-.01	.13	.09	-.05	-.15	.08	.26
Beck Depression Inventory	-.16	-.24	.14	.27	-.36	-.25	.32	.40
Alcohol Self-Efficacy	.39	.42	-.33	-.35	.50	.51	-.50	-.47
Aftercare arm								
Social Role Performance	.17	.27	-.25	-.37	.20	.19	-.19	-.42
ASI Psychiatric Severity	-.08	-.14	.10	.29	-.18	-.28	.12	.36
Beck Depression Inventory	-.29	-.38	.28	.47	-.36	-.30	.26	.46
Alcohol Self-Efficacy	.35	.45	-.34	-.47	.30	.48	-.30	-.49

Entries are Pearson product moment correlations between intervening variables and drinking outcomes that correspond in terms of followup time point. PDA^4 and PDA^{15} refer to percentage of days abstinent at the 4- and 15-month time points, respectively; DDD^4 and DDD^{15} represent drinks per drinking day at these same points. All entries are statistically significant ($p < .05$) except for those underscored.

less likely to be employed than men (41 versus 48 percent), and they were more likely to report a history of physical or sexual abuse (68 versus 30 percent). As shown in table 3, significant differences in the predicted direction were obtained for two of the three AUI scales in this domain, Anxious Concern About Drinking and Drink to Manage Mood.

As in the outpatient study, mixed results were obtained for measures in the role demands domain. Female clients were significantly more likely to report childcare responsibility than were males (36 versus 24 percent); they were also less likely to report living with a spouse (31 versus 38 percent), but this association did not achieve statistical significance. As shown in table 3, no sex differences were found for the Social Role Performance or Family Social Support scales, although aftercare women scored significantly higher than men on the AUI scale, Drink to Deal With Marital Problems.

Predicted differences were also found for the psychopathology/emotional problems domain. As in the outpatient sample, aftercare females were more often diagnosed with affective disorders, and males with ASP. Women scored significantly higher on the ASI Psychiatric Severity scale and on the Beck Depression Inventory (see table 3).

In terms of self-esteem/instrumentality, aftercare women scored lower than men on the PAQ Instrumentality ("masculinity") scale and higher on Expressiveness ("femininity") and Interpersonal Dependency. No differences, however, were found for Alcohol Self-Efficacy.

In sum, the aftercare results roughly paralleled those for the outpatient sample. Predictions were confirmed for 15 of 20 variables across the four treatment need domains. The profiles for aftercare clients of both sexes were consistently higher in problem severity than those for the outpatient sample. The gender differences found in these analyses indicated that women and men have different needs in areas that should be differentially addressed by the study treatments, and that these needs were more marked in the aftercare sample.

Did CBT and TSF treatment delivery differ as anticipated? As with the outpatient sample, the examination of this question began with an analysis of treatment compliance rates. Again, a 2 (Gender) × 2 (Treatment condition) ANOVA was performed. No gender differences were found as a function of treatment assignment.

Aftercare CBT males attended, on average, 8.08 therapy meetings compared with 7.81 sessions for women. TSF attendance rates were also similar for males and females (7.32 and 7.23, respectively).

Next, therapists' descriptions of CBT session content and ratings of the extent to which problem-solving and coping skills were emphasized were examined. Results for the aftercare study are presented in table 8. As noted above, these data should be viewed cautiously, especially during the late weeks of treatment (for Week 12, data are available for only 43 percent of participants). As in the outpatient arm, across sessions the relative proportions of each gender approximate those for the entire aftercare sample.

The pattern for the aftercare sample is similar to that for the outpatient arm. For both genders, there was more focus on problem-solving and coping skills during the core treatment sessions, which accounted for 76 percent of those included in table 8. In general, the same conclusions and caveats apply. Elements of CBT specified in the causal chain were clearly evident in treatment; however, the incompleteness of the data, coupled with the occurrence of elective elements relatively late in the treatment phase, raise questions regarding adequacy of exposure.

Table 5 summarizes aftercare male and female attendance rates at self-help meetings. Compared with the outpatient study, higher rates were exhibited by both men and women in the aftercare arm for both CBT and TSF. In fact, attendance was higher for aftercare CBT clients than it was for TSF outpatients. Contrary to the hypothesis, women in the TSF condition reported significantly higher rates of meeting attendance than did men for all posttreatment followup periods. Aftercare women in TSF also had higher AA Involvement scores at the 3-, 9-, and 15-month followup points, but the difference only reached statistical significance at the last evaluation (M=3.03, SD=1.94 for males,

Table 8.—CBT checklist therapist reports: Aftercare arm

	CBT session topics				Therapist session ratings	
	Core sessions: Problem-solving and drink-refusal skills (%)		Elective sessions: Assertiveness and mood management (%)		Problem-Solving and Coping-Skills Index Mean (SD)[a]	
Session (n)	Males	Females	Males	Females	Males	Females
2 (226)	1.7	0	0	0	3.50 (.62)	3.46 (.57)
3 (206)	4.4	2.1	0	0	3.51 (.57)	3.46 (.51)
4 (189)	76.6	81.8	.1	0	3.79 (.59)	3.65 (.46)
5 (180)	67.9	81.4	.7	0	3.63 (.63)	3.67 (.56)
6 (175)	16.9	29.3	.7	0	3.58 (.71)	3.62 (.61)
7 (170)	11.5	20.0	3.8	0	3.53 (.69)	3.54 (.62)
8 (159)	6.4	5.7	15.3	17.2	3.42 (.76)	3.50 (.62)
9 (153)	7.6	2.9	16.1	17.2	3.46 (.67)	3.47 (.67)
10 (145)	7.2	0	23.2	27.2	3.43 (.80)	3.55 (.69)
11 (135)	5.7	3.4	18.0	41.3	3.39 (.72)	3.43 (.68)
12 (116)	0	0	1.1	3.6	3.22 (.89)	3.19 (.84)

[a] The Problem-Solving and Coping-Skills index represents the mean rating using a response scale ranging from 1 ("not at all") to 5 ("extensively") across four items: (1) discussion of high-risk situations in terms of coping skills used; (2) therapist attempts to "teach, model, rehearse, review, or discuss specific skills"; (3) application of a problem-solving strategy; and (4) formulation of coping strategies to anticipate high-risk situations.

and M=3.88, SD=1.90 for females; t=-2.45, df=216; p=.015).

Did the two treatments differentially affect the intervening variables as predicted? Repeated measures ANOVAs were run using Gender and Treatment condition as between-clients factors and scores on the hypothesized intervening variables (Social Role Performance, ASI Psychiatric Severity, Beck Depression Inventory, and Alcohol Self-Efficacy) at baseline and 3-, 9-, and 15-month followup points as the dependent variables. Again, the results did not support this pathway in the causal chain.

Are the intervening variables related to drinking outcomes? As table 7 shows, the overall pattern of correlations between intervening variables and drinking outcome measures at the end of treatment and 1 year later at the 15-month followup point was similar to that obtained for the outpatient study. In general, the correlations tended to be slightly higher for the aftercare sample.

Thus, although there was considerable variability in the magnitude of the associations (r's ranging from 0.08 to 0.49), the results tended to support this link in the causal chain. For both sexes, scores on variables such as Social Role Performance, Psychiatric Severity, Depression, and Alcohol Self-Efficacy were associated with both the frequency (PDA) and quantity (DDD) of drinking during followup.

In summary, results of the causal chain analyses for the aftercare arm were similar to those obtained for the outpatient sample. Gender differences in treatment needs were documented, and scores on the intervening variables were associated with alcohol consumption measures. However, treatment process data analyses suggested that CBT and TSF were not experienced as predicted. As in the outpatient arm, the emphasis placed on general coping skills and mood management in CBT sessions for female clients was relatively limited. Contrary to predictions, aftercare women attended AA meetings more often than did their male counterparts, and they reported stronger AA involvement during the followup period. Further, no Gender × Treatment condition interactions were found for the intervening outcome variables targeted by the treatments in the causal chain.

Discussion

The direct tests of the gender matching hypothesis failed to support the formulation presented above. Evidence in support of the hypothesis was not obtained in either arm of the trial or in either timeframe under study. Analyses aimed at determining where the hypothesized causal chain "broke down" indicated that some linkages were consistent with the formulation and that other pathways may require reconsideration.

The hypothesized differential treatment needs for males and females were evidenced by baseline gender differences in four treatment need domains: external stressors/negative mood, role demands, psychopathology/emotional problems, and self-esteem/instrumentality. At the other end of the causal sequence, analyses indicated that scores on the intervening variables specified in the formulation were related to drinking outcomes. Thus, the causal chain depicted in figure 1 appears most problematic in terms of differential therapeutic content and gender differences in response to treatment. CBT appeared to address the specific problems and treatment needs of female clients in only a limited fashion. Topics covered in therapy appear not to have been those expected to be of most concern to the women in the trial.

The failure of CBT to address fully the identified treatment needs of women in Project MATCH may reflect the manner in which the treatment was implemented in the trial rather than factors intrinsic to the therapy itself (cf. Donovan 1998). A hallmark of cognitive-behavioral approaches is a functional analysis of the client's drinking behavior. To distinguish CBT from Motivational Enhancement Therapy, this analysis was not performed in Project MATCH, nor were results of the comprehensive baseline assessment made known to CBT therapists. Further, both the individual format and the specified content and pace of the treatment sessions (eight core sessions, a different topic each week) may have impeded skill acquisition. Group sessions permit more modeling, role playing, and behavioral rehearsal of new skills; the content and pace requirements for the treatment reduced the number of elective sessions

pertinent to the specific treatment needs of women that took place. More flexibility in the manual-guided treatment may have produced different results (Donovan 1998).

Perhaps more importantly, the discomfort hypothesized to occur for female clients in the TSF condition was not evident. In terms of session attendance, females were equally compliant in CBT and TSF, and, in the TSF condition, they evidenced higher AA/12-step meeting attendance rates than did male clients in the aftercare study, the arm of the trial in which women had more favorable outcomes than men. This contradiction of the hypothesis formulation may, however, be more apparent than real. The extent to which the meetings attended by women in the trial conform to the traditional view of AA as confrontational and male dominated is not known. AA has become quite diverse in terms of its offerings (McCrady and Delaney 1995), and it may be that women in the trial participated in meetings that did not have, and possibly explicitly rejected, formats and norms that might be construed as hostile toward women or intolerant of female self-assertion. Further, such AA groups may have provided female clients, many of whom were socially isolated, with the means for building a social support network (McCrady and Raytek 1993).

The improvements in response to treatment suggest that both CBT and TSF succeeded in addressing many of the needs of clients of both genders. CBT might have had more impact if more time and attention were specifically devoted to those problems that are more prevalent among women. On the other hand, some of the problems themselves may be as much a consequence of drinking as a cause. This argument has been applied to understanding the negative affect and psychopathology frequently reported by alcoholics (e.g., Schuckit and Hesselbrock 1994; Verheul et al. 2000). To the extent that this is the case, one might expect that sobriety achieved in either treatment would have at least some beneficial effect in the other problem domains.

Finally, the findings do not rule out the possibility that gender-treatment matching may improve outcomes when other treatment factors are considered. "Gender-specific" treatments are usually defined less in terms of general therapeutic philosophy or modality and more in terms of factors that relate to ease of communication (e.g., female therapist, group sessions with other female participants) and content (special attention to specific issues such as sexual and physical abuse, reproductive problems). Such factors were not examined in the present study, and there is some evidence that they can produce superior treatment outcomes (Dahlgren and Willander 1989).

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Part V: Motivation and Self-Efficacy

Motivation Hypothesis Causal Chain Analysis

Alcohol Problem Recognition and Treatment Outcomes

Self-Efficacy as a Matching Hypothesis: Causal Chain Analysis

Motivation Hypothesis Causal Chain Analysis

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ABSTRACT

The motivation hypothesis examined the interaction of initial motivational readiness to change. This was measured by a single score derived from a revised, alcohol-specific version of the University of Rhode Island Change Assessment, with a Motivational Enhancement Therapy (MET) versus Cognitive-Behavioral Coping Skills Therapy (CBT) contrast. Primary outcome analyses revealed a minimal matching effect, with low-motivation clients in MET having more days abstinent in contrast to CBT clients at the very end of the followup period in the outpatient arm of the Project MATCH trial. Examination of the hypothesized mediating and moderating variables that were assumed to account for any matching effect, however, demonstrated that the treatments did not differentially influence client-therapist working alliance, client coping activities, or attendance during treatment. Nor did the treatments differentially affect the posttreatment variables of motivational readiness to change, processes of change, or alcohol abstinence self-efficacy. There was support for some of the hypothesized generic causal mechanisms. Therapy attendance and client reports of the therapeutic alliance influenced drinking outcomes. However, no supporting evidence was found for any proposed treatment-specific causal mechanisms. Instead, there was strong support across all three treatments for the impact of initial motivational readiness to change on working alliance, client processes of change, and, most importantly, on drinking frequency and intensity outcomes over the 1-year followup period and at the 3-year followup. Findings related to motivation were always more robust among outpatient participants compared to aftercare clients. Implications of these findings for MET and for understanding the process of change in alcoholism treatment are discussed.

The motivation hypothesis in Project MATCH was developed based on the ongoing work on the Stages of Change construct from the Transtheoretical Model of intentional human behavior change (DiClemente and Prochaska 1998; Prochaska and DiClemente 1984, 1992; DiClemente 1993*b*; Prochaska et al. 1992). The Stages of Change identified by the model segment the process of change for addictive as well as other behaviors into five steps or stages. These stages begin with Precontemplation, where the individual is not seriously considering change. As individuals experience the process of change, they progress through Contemplation and Preparation stages before reaching the Action Stage where they actually begin to make the change. Finally, after a significant period of action, they reach the Maintenance stage where the change is firmly estab-

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lished and incorporated into the individual's current behavioral repertoire. Each stage is assumed to have its own tasks and issues that need to be resolved before successfully moving to the next stage. Individuals in earlier stages need motivation and commitment and use cognitive and experiential processes of change to move forward. Individuals in the Action and Maintenance stages need behavioral processes to make the change and sustain it (DiClemente and Prochaska 1998; DiClemente and Scott 1997; Prochaska et al. 1992; Perz et al. 1996).

Stage status is assumed to relate to readiness to change a particular behavior and to determine behavior change activity and outcomes. Stages have been assessed using many different measures. This study used a multi-item, multi-subscale measure based on the University of Rhode Island Change Assessment (URICA) measure (McConnaughy et al. 1989; DiClemente and Hughes 1990). The modified version is alcohol problem specific and has four 7-item subscales measuring attitudes related to the Precontemplation, Contemplation, Action, and Maintenance stages. These subscales combine to form a second-order factor that we have labeled Readiness to Change (Carbonari et al. 1994). Although the stages are conceptualized as discrete steps in the process of change, the motivational readiness score can indicate where each subject is on these stages measured as on a continuum of readiness. The continuous measure increases the power and sensitivity of analytic procedures.

The Matching Hypothesis

The hypothesis related to motivation posited that clients low in motivational readiness to change would have better outcomes in the Motivational Enhancement Therapy (MET; Miller et al. 1992) than in Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992). The underlying mechanism for this matching effect was assumed to be the connection between readiness to change the alcohol behavior (in actuality the lack of readiness) with the specific motivational dimensions of MET and the lack of an adequate motivational emphasis in CBT. The motivational strategies delivered by the MET therapist and received by the client assigned to MET were assumed to promote and interact with motivational readiness to change (DiClemente 1991; Miller and Rollnick 1991; Miller et al. 1992). For example, we would expect a differential response from participants in MET compared to those in CBT to the following questions:

- Did the client feel accepted and understood?
- Did the therapist create the tensions that shifted the pros and cons of the problem behavior and address the ambivalence of the client well enough to create movement?
- Were the therapist and client aligned on the goals and tasks of the therapeutic process?
- Did they develop a viable change plan for this client?
- Did the therapist help the client create the level of alcohol abstinence self-efficacy that would support change?

If these tasks were accomplished in MET and less so or not at all in CBT for the low-motivated clients, we should see differences in drinking outcomes that would support the matching hypothesis.

If the motivational dimensions of MET occurred and functioned as hypothesized, it is assumed that the low-motivated client would become more engaged in the therapy and in the process of change than in the comparison therapy. Once engaged, this client would develop increased motivation to change and move to action with greater probability than a similar client in CBT where the focus was on getting clients to take action right from the start by working on identifying triggers and on developing skills. Low-motivated clients would be mismatched most in the CBT condition, which is more action oriented, and would not engage as completely in treatment nor have as good outcomes in CBT without the specific focus on motivation offered in MET (DiClemente et al. 1992). Although no formal hypothesis was made that included clients in the Twelve Step Facilitation (TSF; Nowinski et al. 1992) treatment, we

thought that TSF approaches and the support and modeling provided by AA meetings would contain more motivational components than CBT (DiClemente 1993*a*). Therefore, in terms of participants' drinking outcomes, TSF would possibly fall somewhere between CBT and MET if clients with low motivation could be engaged in the 12-step and AA program.

The hypothesis focused only on the low end of the motivational readiness scale because of the obvious matching potential between MET and low motivation. CBT could be expected to do well with the highly motivated or ready client. However, a motivated client could do well in most treatments. If there were any mismatching at the high end of motivational readiness, it would most likely occur between high-motivated clients and TSF, since there may be a clash between personal motivation to change and the admonition of the 12-step tradition to admit powerlessness over drinking (DiClemente 1993*a*). No firm hypotheses, however, were developed for the highly motivated client. A more complex, higher order interaction with other variables, like interpersonal skills or environment, would be needed to adequately address the interaction of motivation with other aspects of the client-treatment match, particularly at the high end of motivation.

Assumed Causal Chain

The proposed causal chain analyses for the motivational hypothesis focused on the match between low motivation and readiness to change in the MET versus CBT contrast. If this matching and mismatching occur, the explanation should lie in the motivational enhancement dimensions of MET and the lack of readiness of the client (DiClemente et al. 1992). The hypothesized intermediate variables are displayed in figure 1. The causal chain analysis would proceed in the following sequence of events:

1. The interaction of the baseline readiness and the MET treatment would create a more positive and productive therapeutic alliance for the low-motivated clients in MET.
2. Compliance is both an intermediate matching variable and another possible link in the causal chain analysis (DiClemente and Scott 1997). Low-motivated clients in MET could be expected to attend more treatment

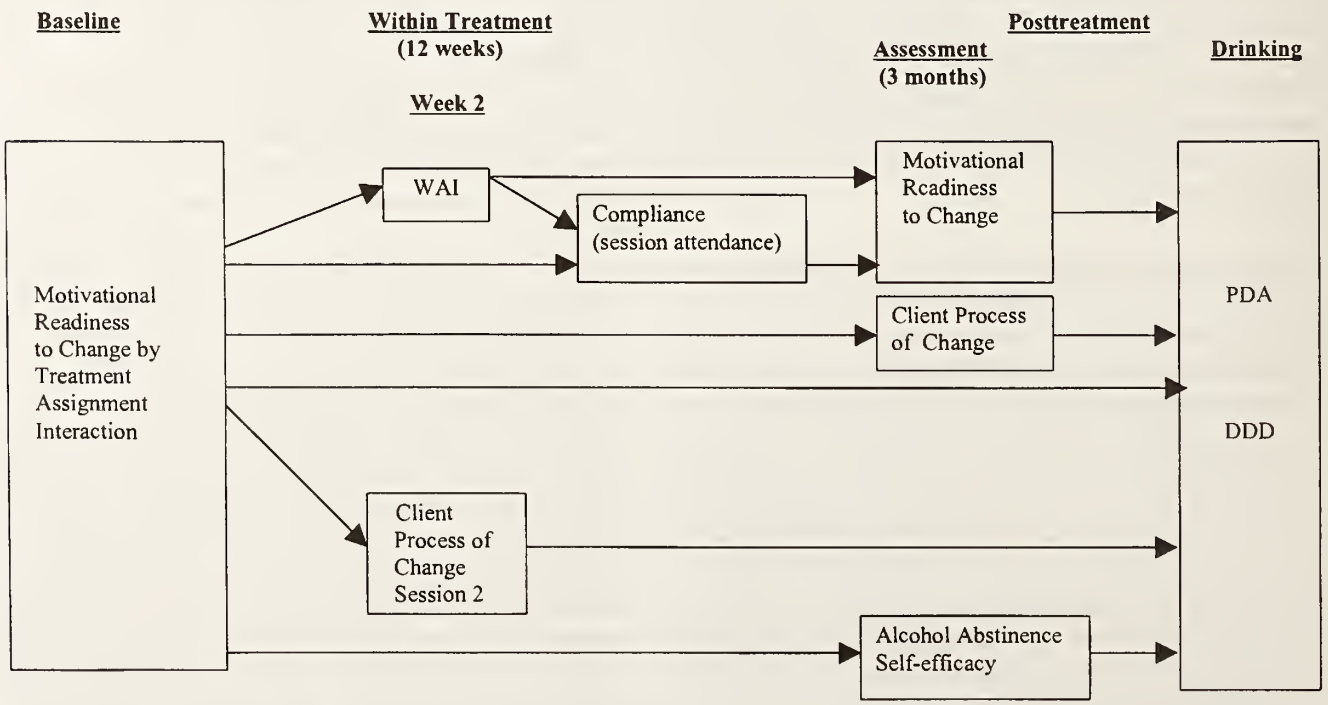

Figure 1. Causal links for the motivation hypothesis.

weeks than would those in CBT. As envisioned for this hypothesis, the therapeutic alliance should influence compliance measured either by the percentage of sessions attended or the number of weeks attended. There should also be a link between compliance and the client's readiness to change at the 3-month followup.

3. Change process activities, as reported by the client at the end of each therapy session and, most comprehensively, at the 3-month evaluation, represent the active coping mechanisms, according to the Transtheoretical Model, by which movement through the stages and behavior change are accomplished. If the MET active ingredients are working as expected, we should see some differences by treatment in process activity either during treatment or posttreatment or at both time points. Change process activity, in turn, should influence drinking outcomes.

4. A more positive therapeutic alliance created through the interaction of MET with low motivation should contribute to an increase in the readiness assessed at the end of treatment. Readiness to change measured at the 3-month followup is the next link in the chain and should ultimately influence posttreatment drinking.

5. Another variable that we believe can influence the matching to outcome connection is client self-efficacy to abstain from drinking measured at posttreatment (DiClemente et al. 1995). Client alcohol abstinence self-efficacy at the 3-month end of treatment evaluation could also serve as an intermediate outcome variable since MET is specifically directed at increasing self-efficacy of the clients in abstaining from their drinking.

6. Drinking outcomes (percentage of days abstinent, PDA; drinks per drinking day, DDD) during treatment and particularly drinking outcomes throughout the 4- to 15-month followup period represent the final links and the criterion variable that all the preceding variables will ultimately impact.

In addition to these causal paths outlined above, motivational readiness could be expected to have some direct effects on intermediate and outcome variables as has occurred in prior research (DiClemente and Prochaska 1998). In figure 2, the arrows suggest all the main effects of motivational readiness on compliance, processes of change, working alliance, and posttreatment drinking.

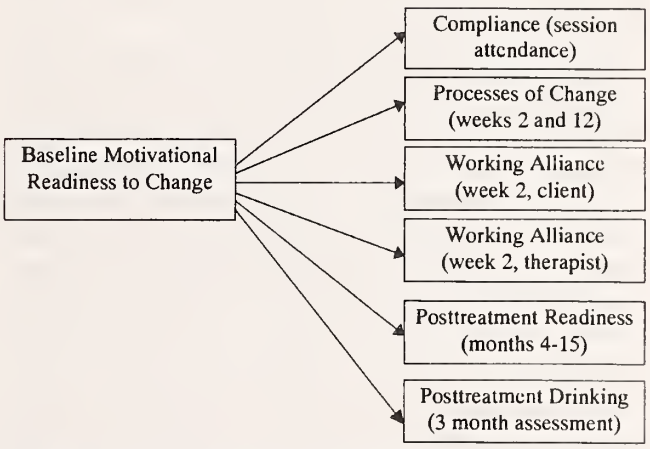
Baseline Motivational Readiness to Change
Compliance (session attendance)
Processes of Change (weeks 2 and 12)
Working Alliance (week 2, client)
Working Alliance (week 2, therapist)
Posttreatment Readiness (months 4-15)
Posttreatment Drinking (3 month assessment)

Figure 2. Baseline motivational readiness to change hypothesized main effects.

Measures

Drinking outcome measures used in our analyses were the Project MATCH primary outcome measures of PDA and DDD as reported in the primary matching hypotheses article (Project Match Research Group 1997*a*; Longabaugh and Wirtz, this volume, pp. 4–17). Analyses were done using transformed variables. Tables reflect retransformed percentage of days and number of drinks.

Motivational readiness to change was assessed using a revised URICA. The original version is generic and has four subscales with 8 items representing each subscale (McConnaughy et al. 1989). Items are rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). For our analyses, a 7-item per subscale version was used that had been supported in prior alcoholism treatment research (DiClemente and Hughes 1990; Carney and Kivlahan 1995; Isenhart 1994). This measure

demonstrated solid psychometric properties with Alpha internal consistency coefficients for the four subscales ranging from 0.74 to 0.82 in the aftercare arm and 0.75 to 0.86 in the outpatient arm. The readiness score for each client was calculated by adding the means of the contemplation, action, and maintenance subscales together and then subtracting the precontemplation mean. This scoring reflects a second-order factor reported earlier (Carbonari et al. 1994). This measure was administered at baseline and at the 3-month posttreatment assessments.

Although sometimes used in analyses as a continuous score, readiness scores for clients in each arm of the trial were divided into thirds on this measure in order to create low, medium, and high motivation subgroups. These three subgroups parallel, for the most part, precontemplation, contemplation, and preparation/action stages of change (Carbonari et al. 1994) and may assist in understanding the interactions and effects for the low-motivation subgroup. Table 1 illustrates the overall means, ranges, and standard deviations of readiness scores for outpatient and aftercare clients in the different level of motivation subgroups.

Table 1. Descriptives for readiness groups (trichotomized)

	Motivational readiness group		
Readiness	Low	Medium	High
Outpatient arm	n=322	n=314	n=310
Mean (SD)	8.7 (1.2)	10.5 (0.5)	12.4 (0.7)
Range	2.6–9.7	9.9–11.3	11.4–14.0
Aftercare arm	n=249	n=262	n=257
Mean (SD)	9.4 (1.1)	11.2 (0.5)	12.7 (0.5)
Range	1.6–10.3	10.4–11.9	12.0–14.0

The Working Alliance Inventory (Horvath and Greenberg 1986) was used to assess the working alliance. The WAI is a 36-item measure that consists of three subscales that address the goals of therapy (Goal), agreement about the tasks of therapy (Task), and the bond between the client and therapist (Bond). Ratings are made on a 7-point Likert-type scale (ranging from 1=never to 7=always) on the extent to which the respondent agrees with the statement, and a global score is calculated by taking the sum of the 36 items (after accounting for reverse-scored items). In Project MATCH, the correlations between subscale scores and the total score ranged from 0.87 to 0.96. Parallel forms were used for therapist and client ratings. Since the client and the therapist completed the WAI following the second session (Connors et al. 1997), those ratings were selected for use in these analyses.

Compliance with treatment was measured as the number of weeks of treatment attendance. Although MET consisted of only four sessions, the sessions extended over the 12 weeks. The three treatments were equal in duration but not intensity. Comparable data for all three treatments were available for weeks 1, 2, 6, and 12 (see Mattson et al. 1998 for greater detail).

Processes of change represent client coping activities and measures of processes of change that have been used with different addictive behaviors (DiClemente and Prochaska 1998; Prochaska et al. 1988; Snow et al. 1994). In Project MATCH, processes of change were assessed using a 40-item scale that contained subscales for each of 10 processes with 4 items for each process. Clients were asked to indicate on a 5-point Likert scale (ranging from 1=never to 5= very frequently) how often they had experienced each of the activities or events listed. Twenty of the items comprise experiential processes, which tap into cognitive and affective processes such as consciousness raising and self-reevaluation, and twenty items comprise behavioral processes such as stimulus control and contingency management. Both the 20-item subscales and the 40-item total scale have good psychometric properties with Chronbach Alphas of 0.90 for the experiential and 0.91 for the behavioral subscales (DiClemente et al. 1996).

At posttreatment, clients completed the full 40-item version. A brief 8-item version of the processes of change measure was administered at the end of each therapy session as part of a Client Session Report. This measure contained four behavioral process items, two experiential process items, and two helping relationship items.

Self-efficacy was assessed using the Alcohol Abstinence Self-Efficacy Scale (DiClemente et al. 1994). Clients rated their confidence to abstain from alcohol in 20 different situations on a 5-point Likert-type scale (ranging from 1=not at all to 5=extremely). Clients also rated their degree of temptation to drink in these same 20 situations. Scores were computed separately for confidence and temptation. The mean level of efficacy was computed such that the scores ranged from 1 to 5, with 1 being not very confident and 5 being very confident across all 20 situations. Temptation to drink scores were computed in the same way.

Results

Main Effects

Motivational readiness to change emerged as one of the best predictors of drinking behavior during the treatment period (Project MATCH Research Group 1998*a*) and throughout the posttreatment period for the clients in the outpatient arm of the trial. Motivation predicted both PDA and DDD outcomes for each of the followup periods for these clients (table 2). This initial readiness to change continued to be the best predictor of both PDA and DDD drinking outcomes at the 3-year posttreatment followup (Project MATCH Research Group 1998*b*). However, initial motivational readiness to change did not predict either during treatment or posttreatment drinking outcomes in the aftercare arm. Mean values of motivational readiness to change were slightly higher for clients in the aftercare arm than for those in the outpatient arm. However, assessing readiness while clients were on the inpatient unit or engaged in intensive treatment did not yield scores on this measure of motivation that were related to posttreatment drinking.

Matching Effects

The test of the motivation matching hypothesis provided some support for the matching hypothesis only in the outpatient arm. For outpatient clients, significant interaction effects for the hypothesized CBT versus MET contrast as well as for the CBT versus TSF contrast occurred for posttreatment drinking outcomes but not for drinking during treatment (table 3). For the aftercare clients, there were no significant

Table 2. Comparison of group means and standard deviations for quarterly posttreatment drinking

Posttreatment drinking	Motivational readiness group			Comparisons
	Low	Medium	High	
Outpatient arm				
PDA				
Quarter 1***	.72 (.33)	.76 (.31)	.81 (.29)	low<high
Quarter 2***	.69 (.33)	.75 (.33)	.80 (.30)	low<medium,high
Quarter 3***	.68 (.34)	.74 (.35)	.78 (.31)	low<medium,high
Quarter 4***	.65 (.36)	.76 (.32)	.78 (.32)	low<medium,high
DDD				
Quarter 1***	5.5 (6.4)	4.3 (4.9)	4.3 (5.3)	low>medium,high
Quarter 2***	5.5 (5.5)	4.5 (5.1)	4.3 (5.5)	low>medium,high
Quarter 3***	5.5 (5.9)	4.5 (5.3)	4.1 (5.5)	low>medium,high
Quarter 4***	5.5 (5.7)	4.1 (5.0)	4.1 (5.4)	low>medium,high
Aftercare arm				
PDA				
Quarter 1	.84 (.28)	.85 (.28)	.85 (.28)	ns
Quarter 2	.83 (.28)	.81 (.32)	.81 (.32)	ns
Quarter 3	.81 (.30)	.80 (.33)	.81 (.32)	ns
Quarter 4	.81 (.31)	.78 (.34)	.80 (.34)	ns
DDD				
Quarter 1	4.1 (6.9)	4.0 (7.0)	3.7 (5.9)	ns
Quarter 2	3.9 (6.7)	4.6 (7.1)	4.9 (8.1)	ns
Quarter 3	3.8 (5.5)	4.5 (7.3)	4.6 (8.2)	ns
Quarter 4	4.0 (6.1)	4.7 (7.5)	4.2 (8.0)	ns

NOTE: The four different quarters by group were analyzed individually using ANOVA procedures. Post hoc comparisons were made using the Tukey's B procedure. Pairwise comparisons that were significant are designated by a < or > symbol. If differences were not significant, a comma was used. For outpatient arm, *N*'s ranged from 288 to 313. For aftercare arm, *N*'s ranged from 229 to 250; all comparisons were nonsignificant. PDA=percentage of days abstinent; DDD=drinks per drinking day. ***$p<.005$

Table 3. Hierarchical linear modeling results for the matching hypothesis

MV × Tx contrast	Overall effect (*F*)	CBT-MET (*t*)	CBT-TSF (*t*)	MET-TSF (*t*)
Outpatient arm				
Within Tx				
MV × Tx				
PDA	0.05	-0.02	-0.27	-0.24
DDD	0.68	-0.69	0.48	1.16
MV × Tx × T				
PDA	0.44	-0.35	0.59	0.92
DDD	0.03	0.20	-0.02	-0.22
Posttreatment				
MV × Tx				
PDA	0.03	-0.16	-0.23	-0.05
DDD	0.17	-0.04	0.50	0.50
MV × Tx × T				
PDA	4.50**	-2.83**	2.25**	-0.76
DDD	3.43*	-1.63	-2.58**	-0.77
Aftercare arm				
Within Tx				
MV × Tx				
PDA	2.61	-2.23*	-1.52	0.73
DDD	1.38	1.66	0.82	-0.84
MV ×Tx × T				
PDA	2.16	-1.79	-1.79	0.03
DDD	1.36	1.60	1.11	-0.51
Posttreatment				
MV × Tx				
PDA	2.15	-0.89	-2.07*	-1.14
DDD	2.10	1.80	1.72	-0.10
MV ×Tx × T				
PDA	0.67	1.05	0.93	-0.13
DDD	0.37	-0.85	-0.28	0.56

NOTE: MV=matching variable, Motivational Readiness; Tx =treatment; T=linear time; PDA=percentage of days abstinent; DDD=drinks per drinking day. F tests were used for the overall effect, and t-tests were used for pairwise treatment contrasts. *p<.05 **p<.025 (refers to Bonferroni-corrected level of significance)

motivational readiness by treatment interaction effects (Bonferroni corrected) for the within treatment or posttreatment drinking outcomes for the hypothesized contrast.

As mentioned, there was a significant attribute by treatment by time interaction for outpatient clients on posttreatment drinking that is illustrated in figure 3. These results are complicated. In the month immediately following the end of treatment, low-motivated clients in the CBT condition had significantly more days abstinent compared to those in MET, contrary to the hypothesis. However, with the passage of time, low-motivated CBT clients increased their drinking and decreased their percentage of days abstinent. In contrast, toward the end of the followup period, low-motivated MET clients appeared to gain more days abstinent, so that by the last month of the followup period, low-motivated clients in MET had significantly more abstinent days than low-motivated clients in CBT. This late-emerging effect could be due to the MET clients beginning to take more responsibility for their drinking, as was urged in the MET condition, combined with the failure of the CBT clients to sustain abstinence over time. However, a late-emerging effect that lasted for only 1 month provided minimal support for the motivation by treatment interaction hypothesized. Thus, it would be interesting to see if the proposed causal chains assumed to be operating were actually visible in the subsequent analyses.

At the 3-year followup, which assessed drinking outcomes for the 90 days prior to the end of the third year posttreatment for outpatient participants, there was no support for the motivation matching contrast. Percentage of days abstinent for the low-motivated CBT clients was approximately 58 percent (*SD*=39 percent) and for the MET clients was 54 percent (*SD*=38 percent). Thus, this late-emerging effect at the end of the first year did not continue to produce a long-term effect. However, it is not known when that effect disappeared between the posttreatment month 12 assessment and the 36-month assessment.

A nonhypothesized significant interaction of motivation by treatment by time occurred in the CBT versus TSF contrast for both PDA and DDD, again only in the outpatient arm (not

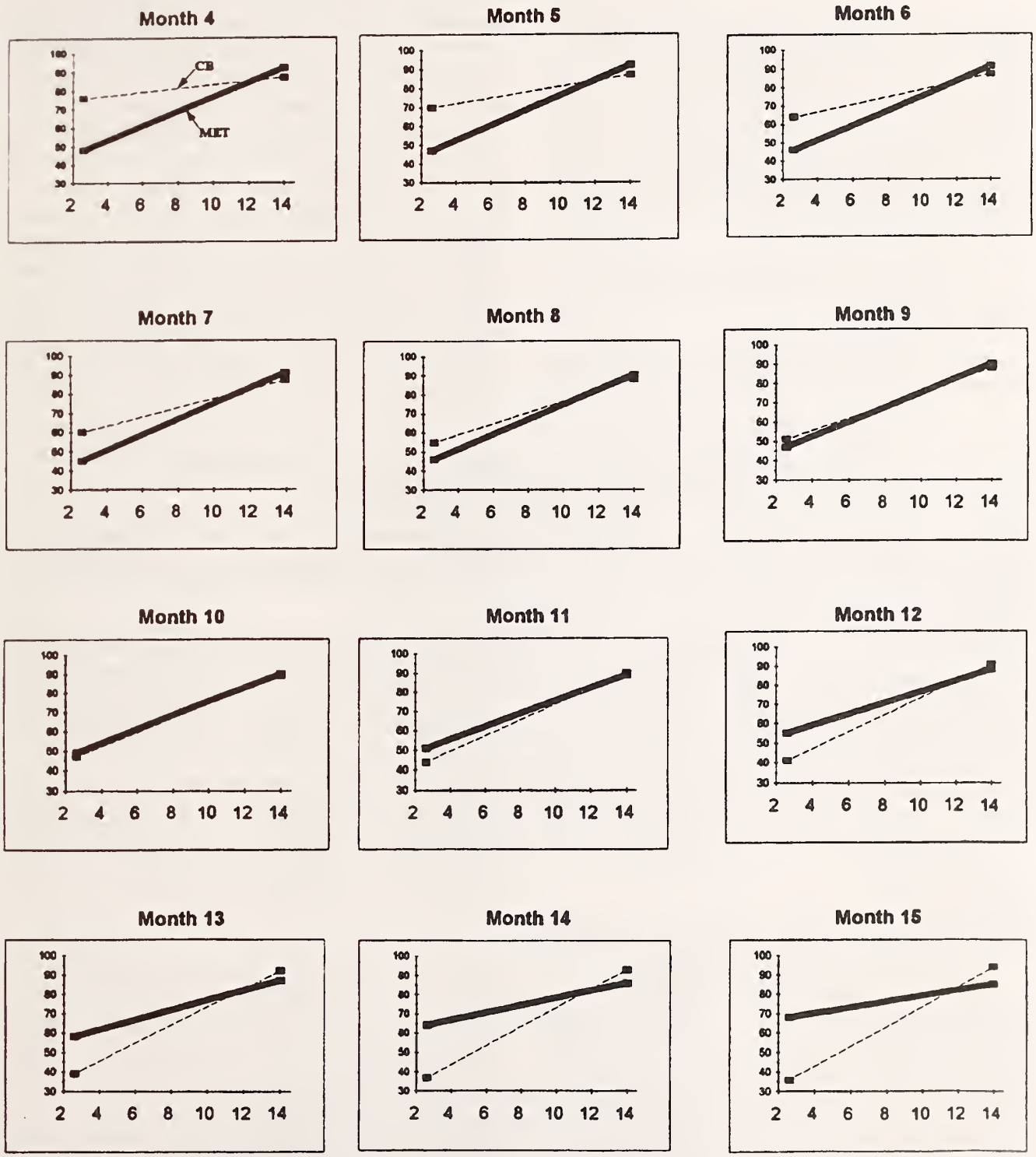

Figure 3. Monthly posttreatment plots of percentage of days abstinent for treatment by time by attribute interaction for motivation contrast between CBT and MET among outpatients. The interaction at month 15 was significant in the predicted direction ($p<.05$). The vertical axis represents percentage of days abstinent and the horizontal axis represents motivation scores. (Reprinted with permission from *Journal of Studies on Alcohol*, Vol. 58, pp. 7–29, 1997. Copyright by Alcohol Research Documentation Inc., Rutgers Center of Alcohol studies, Piscataway, NJ 08854.)

shown). What seems to be occurring in this contrast is that at the high end of the readiness to change scale, TSF clients were reporting more abstinence and fewer drinks per drinking day than their CBT counterparts immediately post-treatment at the beginning of the followup period. However, these differences disappeared by the end of the followup period.

Causal Chain Analysis

Working Alliance

The first interaction between motivation and treatment was assumed to be an interaction with the working alliance as evaluated independently by both the client and the therapist. Analyses of the client and therapist reports completed immediately after the second session of treatment indicated that there was a significant main effect for motivational readiness. In both the outpatient and the aftercare arms of the trial, individuals with greater readiness to change at baseline reported significantly higher levels of alliance with the therapist on therapeutic task, goals, and bond, compared with their low-readiness counterparts (table 4). Therapist reports of task and goal on the WAI were also related to client readiness in the outpatient

Table 4. Comparison of group means and standard deviations for working alliance scores at Session 2

Working Alliance	Motivational readiness group			Tukey's B comparison
	Low	Medium	High	
Outpatient arm				
Client ratings				
Total score***	205.0 (24.7)	209.9 (24.8)	219.1 (21.0)	low<medium<high
Task subscale***	68.9 (9.0)	70.8 (8.8)	74.1 (7.2)	low<medium<high
Goal subscale***	68.4 (8.8)	69.5 (9.0)	73.5 (7.5)	low,medium<high
Bond subscale***	67.6 (9.3)	69.7 (9.4)	71.4 (8.6)	low<medium<high
Therapist ratings				
Total score***	188.0 (25.0)	191.1 (24.2)	196.2 (24.0)	low,medium<high
Task subscale***	62.2 (8.7)	63.5 (8.1)	65.2 (8.5)	low,medium<high
Goal subscale***	60.7 (9.9)	61.9 (9.7)	64.2 (9.3)	low,medium<high
Bond subscale	65.1 (8.6)	65.7 (8.5)	66.8 (8.1)	ns
Aftercare arm				
Client ratings				
Total score*	208.2 (25.6)	213.6 (20.8)	221.1 (22.6)	low<medium<high
Task subscale*	70.1 (8.9)	71.7 (7.7)	74.6 (8.1)	low,medium<high
Goal subscale*	69.2 (9.2)	71.4 (7.6)	73.6 (8.2)	low<medium<high
Bond subscale*	68.9 (9.8)	70.4 (7.9)	72.9 (8.3)	low,medium <high
Therapist ratings				
Total score*	192.9 (26.5)	195.4 (24.5)	196.8 (26.6)	ns
Task subscale*	64.6 (8.8)	65.4 (8.3)	66.3 (8.5)	ns
Goal subscale*	62.9 (10.2)	64.2 (9.3)	64.6 (10.0)	ns
Bond subscale	65.5 (9.1)	65.8 (8.8)	65.9 (9.4)	ns

NOTE: The total score and three different subscale scores by group were analyzed individually using ANOVA procedures. Post hoc comparisons were made using the Tukey's B procedure. Pairwise comparisons that were significant are designated by a < symbol. If differences were not significant, a comma was used. *N*'s range from 247 to 269 in the outpatient arm and from 181 to 213 in the aftercare arm.
*p<.05 ***p<.005

but not the aftercare arm of the trial in exactly the same manner (higher client readiness= greater reported alliance).

Working alliance ratings at Session 2, whether provided by the client or the therapist, were significant predictors of treatment participation and drinking behavior during treatment and the 12-month posttreatment period in the outpatient arm of the trial (Connors et al. 1997). Ratings of the therapeutic alliance by the clients at Session 2 in the aftercare arm were not predictive of participation or outcome. However, ratings of the alliance by the therapists in the aftercare sample did predict PDA during treatment and follow-up. Thus, there is evidence of a significant effect of working alliance on participation and drinking outcomes that is most strongly demonstrated in the outpatient arm. However, this effect is modest in the amount of variance (3.5 percent at most) explained. Moreover, there were no significant differences among the three therapies on the WAI scores in either arm.

Additional analyses of the alliance data revealed that the best predictor of the client WAI ratings was the client's motivational readiness to change, with Beta weights of 0.25 in outpatient and 0.23 in aftercare (Connors et al. 2000). Motivation acts as a mediator of the effect of the alliance on drinking outcomes. When motivation is added into the WAI prediction equation, the ability of the WAI to predict drinking outcomes is weakened significantly, indicating a connection between motivation and ratings of the alliance.

In all these analyses, however, there were no significant interactions between type of treatment and motivational readiness related to the WAI scores. Nor were there any significant differences in WAI scores by treatment. Thus, WAI scores appeared related to client readiness to change independently of the type of treatment offered. There was no support for the hypothesized causal link connecting specific treatment effects on the working alliance depending on level of motivation. Low-motivated MET clients did not demonstrate significantly better working alliances with the therapist than did their CBT counterparts.

Compliance

Project MATCH clients had very high levels of compliance with treatment attendance. On average, clients attended 7 to 8 of the scheduled 12 sessions and 3 to 4 of the 4 MET sessions (Mattson et al. 1998). Treatment attendance correlated moderately with drinking outcome (PDA) immediately posttreatment for both CBT (r=0.39) and TSF (r=0.44) clients in both arms of the trial. However, there was little demonstrated connection between treatment attendance and PDA for the MET clients (r=0.12 at posttest and 0.06 at the 1-year followup), possibly due to a ceiling effect in their 4-session attendance. Thus, there was a link between compliance and outcomes as hypothesized.

However, there was no relationship between client motivational readiness and treatment compliance in either arm of the trial. Moreover, there was no interaction between treatment condition and motivational readiness in terms of compliance in either arm of the trial. As can be seen in table 5, weeks in treatment were very similar for all treatment groups. Motivational readiness to change did not predict compliance as was hypothesized. There was no support for the hypothesized causal link between levels of readiness, type of treatment, and compliance. This finding is at variance with several prior studies where Stage of Change was predictive of attendance and compliance (Smith et al. 1995; DiClemente et al. 1991).

Table 5. Comparison of group means and standard deviations for treatment compliance by motivational readiness group

Treatment compliance	Motivational readiness group		
	Low	Medium	High
Outpatient	n=322	n=314	n=310
Number of treatment weeks	8.6 (4.2)	8.7 (4.3)	8.6 (4.2)
Aftercare	n=249	n=262	n=257
Number of treatment weeks	7.7 (4.9)	8.0 (4.7)	8.4 (4.4)

NOTE: The number of treatment weeks by group was analyzed using ANOVA procedures. Post hoc comparisons were made using the Tukey's B procedure. All comparisons were nonsignificant.

During-Treatment Change Process Activity

In both arms of the trial, behavioral and experiential processes of change reported by clients at the 3-month posttreatment assessment were not significantly different across the three treatments (table 6). The brief assessments of process activity reported by clients during treatment in their client session reports indicated that TSF clients had slightly but significantly higher levels of experiential process activity than CBT clients in the outpatient arm, and than MET clients in the aftercare arm. With this minor exception, individuals in all three treatments reported similar levels of experiential and behavioral process activity despite the fact that the three treatments had very different philosophies, therapists, and active ingredients as assessed by objective and independent observers (Carroll et al. 1998).

There were, however, significant effects of baseline motivational readiness to change on client process activity both during and immediately after treatment in both the outpatient and aftercare arms of the trial (table 7). Clients with higher levels of motivational readiness to change at baseline reported significantly higher levels of process activity during treatment and at the posttreatment assessment. In the outpatient arm, the differences in process activity between groups high and low in motivation were more pronounced. However, there were no significant interactions between motivational readiness and the specific treatments on process activity at any time point. Low-motivated clients did not demonstrate more process activity in MET than in CBT. Thus, there was no support for the causal link assumed to involve the processes of change. However, for the outpatient and aftercare clients, their behavioral process activity reported at Session 2 and both behavioral and experiential process activity at the end of treatment did predict posttreatment drinking outcomes. Once again, there was support for the hypothesized relationship between processes of change and drinking outcomes in general but not for the treatment-specific contrast between MET and CBT.

Posttreatment Readiness to Change

Another element in the causal chain predicted significant differential shifts in readiness to change from baseline to posttreatment

Table 6. Comparison of group means and standard deviations for processes of change by treatment assignment

Processes	CBT	MET	TSF	Comparisons
Outpatient arm				
Session 2				
Total	3.1 (0.7)	3.1 (0.8)	3.1 (0.7)	ns
Behavioral	3.5 (0.9)	3.3 (1.0)	3.4 (0.9)	ns
Experiential*	2.6 (1.0)	2.8 (1.0)	2.9 (1.0)	CBT<TSF
Helping relationship	2.8 (1.1)	2.9 (1.1)	2.7 (1.0)	ns
Posttreatment				
Total	3.1 (0.6)	3.1 (0.6)	3.1 (0.7)	ns
Behavioral	3.2 (0.7)	3.1 (0.7)	3.1 (0.8)	ns
Experiential	3.0 (0.6)	3.0 (0.6)	3.1 (0.7)	ns
Aftercare arm				
Session 2				
Total	3.4 (0.8)	3.3 (0.8)	3.4 (0.7)	ns
Behavioral	3.7 (0.9)	3.6 (0.9)	3.7 (0.9)	ns
Experiential*	2.9 (1.0)	2.8 (1.0)	3.0 (0.8)	MET<TSF
Helping relationship	3.3 (1.1)	3.3 (1.1)	3.2 (1.1)	ns
Posttreatment				
Total	3.3 (0.6)	3.3 (0.6)	3.3 (0.6)	ns
Behavioral	3.4 (0.7)	3.3 (0.7)	3.4 (0.7)	ns
Experiential	3.2 (0.7)	3.2 (0.7)	3.2 (0.6)	ns

NOTE: The four different types of processes by group were analyzed individually using ANOVA procedures. Post hoc comparisons were made using the Tukey's B procedure. Pairwise comparisons that were significant are designated by a < symbol. Mean values range from 1 to 5. *N*'s range from 229 to 318 (outpatients) and from 213 to 234 (aftercare) for posttreatment processes and are smaller for Session 2 processes.
*$p<.05$

Table 7. Comparison of group means and standard deviations for processes of change by motivational readiness group

Processes	Motivational readiness group			Tukey's B comparisons
	Low	Medium	High	
Outpatient arm				
Session 2				
Total***	2.8 (0.7)	3.1 (0.7)	3.3 (0.7)	low<medium<high
Behavioral***	3.2 (0.9)	3.3 (1.0)	3.7 (0.9)	low,medium<high
Experiential***	2.4 (1.0)	2.9 (1.0)	3.0 (1.0)	low<medium<high
Helping relationship***	2.5 (1.0)	2.8 (1.0)	3.0 (1.2)	low<medium<high
Session 6				
Total***	2.9 (0.7)	3.2 (0.7)	3.3 (0.8)	low<medium,high
Behavioral***	3.4 (0.9)	3.5 (0.9)	3.8 (0.9)	low,medium<high
Experiential***	2.3 (0.9)	2.8 (1.0)	2.8 (1.1)	low<medium,high
Helping relationship*	2.7 (1.0)	3.0 (1.0)	3.0 (1.1)	low<medium,high
Posttreatment				
Total***	2.9 (0.6)	3.1 (0.5)	3.3 (0.6)	low<medium<high
Behavioral***	2.9 (0.7)	3.2 (0.6)	3.4 (0.7)	low<medium<high
Experiential***	2.8 (0.7)	3.1 (0.6)	3.2 (0.7)	low<medium<high
Aftercare arm				
Session 2				
Total***	3.2 (0.7)	3.4 (0.8)	3.6 (0.8)	low,medium<high
Behavioral***	3.5 (0.9)	3.7 (0.9)	3.9 (0.9)	low<high
Experiential***	2.7 (0.9)	2.8 (1.0)	3.1 (0.9)	low,medium<high
Helping relationship***	3.0 (1.1)	3.2 (1.1)	3.5 (1.1)	low,medium<high
Session 6				
Total***	3.1 (0.9)	3.3 (0.8)	3.5 (0.8)	low<high
Behavioral***	3.4 (1.0)	3.6 (0.9)	3.8 (0.9)	low<medium<high
Experiential	2.7 (1.0)	2.7 (1.0)	2.8 (1.0)	ns
Helping relationship	3.2 (1.1)	3.2 (1.1)	3.4 (1.1)	ns
Posttreatment				
Total***	3.1 (0.6)	3.3 (0.6)	3.5 (0.7)	low<medium<high
Behavioral***	3.2 (0.7)	3.4 (0.7)	3.6 (0.8)	low,medium<high
Experiential***	3.0 (0.7)	3.2 (0.6)	3.4 (0.7)	low,medium<high

NOTE: The four different types of processes by group were analyzed individually using ANOVA procedures. Post hoc comparisons were made using the Tukey's B procedure. Pairwise comparisons that were significant are designated by a < symbol. If differences were not significant, a comma was used. Mean values range from 1 to 5. *N*'s range from 290 to 310 (outpatient) and from 214 to 233 (aftercare) for posttreatment processes and are smaller for Sessions 2 and 6 processes.
*** $p<.005$ * $p<.05$

produced by the matching of treatments with motivational readiness group. Once again, there were significant differences between groups of individuals high and low in motivational readiness in terms of their changes in readiness during the course of treatment but no significant effects by treatment or any treatment by readiness interactions. There were changes in motivational readiness from pretreatment to posttreatment that differed by initial level of motivation. However, the direction of the change was somewhat surprising. The high-readiness group showed a decrease in motivational readiness larger than the

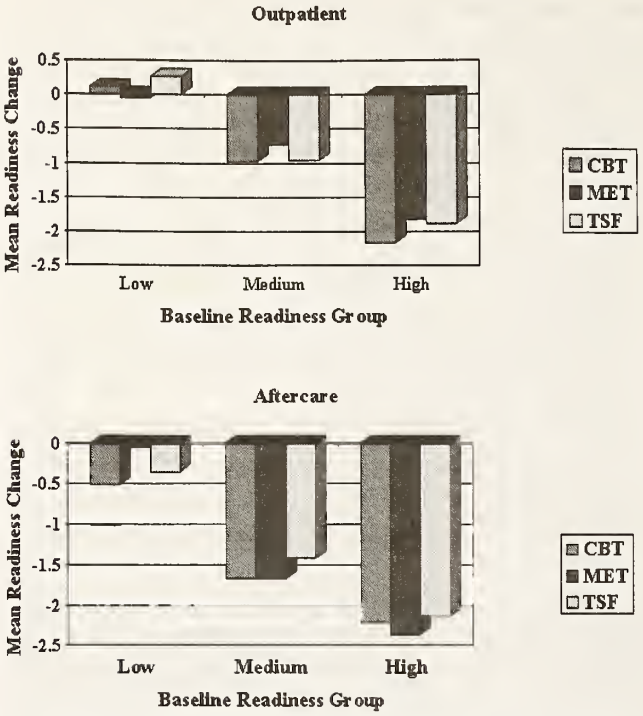

Figure 4. Mean motivational readiness by baseline readiness groups.

medium-readiness and low-readiness groups. This occurred in both arms of the trial (figure 4). Contrary to what we hypothesized, a decrease in readiness score from pretreatment to posttreatment was a positive indicator of drinking outcome. In addition, end of treatment (3-month assessment) readiness scores did not predict posttreatment drinking outcomes in either outpatient or aftercare arms.

Client motivation as assessed by the URICA at the end of treatment was problematic and confusing. What seemed to be occurring was that client ratings on the four URICA subscales shifted in understandable but unexpected directions once the clients had achieved some successful cessation of drinking (Carbonari et al. 1994; Carbonari and DiClemente 2000). Thus, the overall readiness scores at posttreatment were not comparable to pretreatment readiness scores. When decomposed back into the constituent subscales, however, some end of treatment subscales were predictive of posttreatment drinking, wth the action subscale scores being a positive predictor of drinking outcomes and maintenance scores being a negative predictor. It was also clear that these shifts occurred differentially by readiness group. The high baseline readiness group changed drinking behaviors and responses to the URICA items differently from the low readiness group. Once again, however, there were no treatment-specific differences found in the shifts in motivational readiness from pretreatment to posttreatment as was found with the other hypothesized causal links.

Alcohol Abstinence Self-Efficacy

Efficacy to abstain from drinking across a number of situations was examined to see if the assumed motivational readiness by treatment interaction in the prediction of client abstinence self-efficacy at the 3-month assessment existed. However, no significant interactions were found in either arm of the trial. Moreover, efficacy did not differ by treatment condition. Posttreatment self-efficacy was related to drinking outcomes during the followup period for outpatients (DiClemente et al. this volume; Project MATCH Research Group 1997*b*). However, there was no support for a causal link or even a differential impact of baseline motivational readiness interacting with the treatments to affect client efficacy to abstain from drinking.

Discussion

There was some support among outpatient clients for a delayed matching effect for motivational readiness to change in Project MATCH. However, the hypothesized superiority of MET for the low-motivated clients occurred during the last month of the 12-month followup period. Moreover, immediately posttreatment, PDA and DDD outcomes were in the opposite direction from those hypothesized, with the low-motivated CBT clients doing better. This suggested that the hypothesized relationships forming the causal chain for this hypothesis would not emerge. Indeed, none of the causal linkages between treatments and motivation were demonstrated in our analyses. There were no significant differences or interactions for low-motivated clients in MET compared to CBT on reported working alliance, compliance, processes

of change, posttreatment readiness, or abstinence self-efficacy.

What did emerge in these analyses was support for a generic, across treatment, modest positive relationship link among baseline motivation, the therapeutic alliance, and treatment attendance/compliance with posttreatment drinking outcomes. The most striking findings, however, were the strong, independent, predictive effects of baseline motivational readiness to change on drinking outcomes and other variables. Motivation at intake predicted working alliance during treatment, processes of change during and after treatment, and shifts in posttreatment readiness to change across both arms of the trial. Motivation at intake also predicted drinking outcomes throughout the 1 year and also at a 3-year followup after treatment in the outpatient arm of the trial.

MET did not differentially affect low-motivated clients as expected in the motivational hypothesis, even though MET was discriminable from the other two treatments and MET therapists did appear to be adhering to the manual (Carroll et al. 1998). With the exception of the one posttreatment matching outcome finding at month 12, MET did not interact with motivation as hypothesized. At the end of the 3-year followup, the hypothesized motivation by treatment effect was not evident. It may be that these less motivated MET clients did learn that change of their drinking was their responsibility so that over time they began to achieve greater abstinence during the 1-year posttreatment period. However, there were few indications on any process measures during or after treatment to support this claim. Low-motivated MET clients did not have any higher abstinence self-efficacy or process activity immediately posttreatment. Motivation by treatment interactions were almost nonexistent. Therefore, it is not surprising that there was not much support for matching effects.

In marked contrast to the lack of interaction effects between treatments and motivation were the highly significant effects of motivational readiness to change on the working alliance as reported by both client and therapist as well as on client processes of change both during and immediately after treatment. These effects were always in the expected direction, with higher levels of motivation for change associated with better working alliance and greater process activity. Moreover, the baseline motivational readiness to change predicted drinking throughout the posttreatment period (Project MATCH Research Group 1997*a*) and all the way out to 39 months postbaseline for the outpatients (Project MATCH Research Group 1998*b*). Motivation related to all positive predictors of drinking outcomes and demonstrated a moderator effect on the relationship between working alliance and drinking outcomes. Both process and outcome data supported the role of motivational readiness to change in achieving and sustaining abstinence and decreasing the intensity of drinking.

Although significant relationships in the expected direction were found for motivational readiness to change with working alliance and processes of change among the aftercare clients, results in this arm of the study were more variable and less predictive overall. Baseline values of readiness to change were not predictive of posttreatment drinking, contrary to outpatient results. There are several possible explanations for these differences between outpatient and aftercare clients in terms of their self-assessments at baseline and at posttreatment. One possible explanation is that the URICA scales are useful only for clients entering treatment and measure Precontemplation, Contemplation, and Action better when clients currently have the problem and are in a pre-action stage. Most prior studies using the URICA have examined outpatients who were at the initial entry point of therapy. Aftercare clients, on the other hand, were assessed for the first time while they were on an inpatient unit or at an intensive day treatment setting. Abstinence was supported by the restrictions and safety of being in a hospital or day treatment setting. Thus, their perceptions of their readiness to change could be overly optimistic. Inaccuracies in self-evaluation could lead to poor predictive ability of the measure. This interpretation is supported by the findings related to self-efficacy (DiClemente et al. this volume).

In addition, once individuals have achieved abstinence, responses to the questions in the

Precontemplation, Contemplation, Action, and Maintenance subscales of the URICA become more problematic. Once abstinence is achieved, action and maintenance subscale scores become better predictors of continuing successful abstinence since these subscales contain items reflecting commitment to stop drinking and struggling with relapse (Carbonari et al. 1994). In fact, once clients become abstinent, they begin to increase their agreement with precontemplation items since they see themselves as resolving the problems and not resisting change. Evaluation of state-like constructs such as readiness to change and self-efficacy are sensitive to current status in making the behavior change and to an intensive/inpatient treatment setting. In retrospect, if we could have assessed readiness and efficacy during the first week after clients were released from the more intensive treatment, we might have obtained a measure of these constructs that would be a more relevant predictor of outcomes.

In the aftercare arm, there was a lawful, expected relationship between motivation and process activity, with more motivated clients using more processes during and after treatment. More motivated clients were doing more to change. However, differences between the motivational groups were not large. Even the less motivated clients were using processes of change at rather high levels, so there may not have been enough variability to make a difference in drinking outcomes. In aftercare, there were fewer significant differences by motivation for process activity at Session 2, Session 6, and posttreatment. Low-motivated aftercare clients had process scores that were equal to medium or high groups among outpatients. However, despite restriction in range, even for these aftercare clients, process activity in Session 2 and posttreatment significantly predicted posttreatment drinking.

Although there are compelling data supporting a common path of change where readiness to change and processes of change are related to each other and to drinking outcomes, there is little evidence that the treatments differentially affected or interacted with any of these variables. Clients in all three treatments reported similar working alliance scores, process of change activities, abstinence self-efficacy, and levels of compliance. Across all three treatments, there was good evidence for client differences in readiness to change. We need to continue to examine this homogeneity of treatment effect among a heterogeneous population of participants. Clients appear to be experiencing a common process of change that is being influenced similarly across the three different treatments.

Through a variety of experiences and contextual variables (i.e., life events), individuals enter therapy with varying levels of motivation that lead to change activity occurring in the pretreatment period. Thus, many clients may have done significant work getting ready to make changes in their drinking prior to entry into treatment. The predictive ability of the Session 2 variables (working alliance, processes of change) indicates that clients were employing critical coping activities early in the treatment. MET may not be able to influence this process with only the two initial sessions in any significant way above and beyond what has already occurred.

These results indicate that we need to understand better the larger process of change for drinking behavior in order to be able to better promote movement through that change process. Very different treatments delivered in different doses of intensity did not affect this change process differentially. Over the long run, Motivational Enhancement Therapy did as well as more established and intensive treatments. However, in the variables assessed in Project MATCH, MET did not affect client motivation or movement through the process of change in any way that differed from CBT and TSF. Clearly, we need to understand how to influence motivational readiness to change.

It has been argued that this trial had only very motivated clients and that the level of motivation was too high for the entire sample to influence outcomes with our treatments. However, the motivational levels on the URICA reported among outpatients in this trial were comparable to those from a general outpatient treatment program with few exclusion criteria (DiClemente and Hughes 1990). Moreover, the fact that baseline levels of motivation continue

to predict drinking outcomes well beyond the end of treatment indicates that there was enough variability to affect drinking outcomes. However, none of the treatments interacted with initial levels of motivation sufficiently to disrupt the relationship between motivation on entry to treatment and drinking outcomes. Clearly, we need to understand better how treatments interact with the process of change in order to improve our ability to influence motivation to change.

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Alcohol Problem Recognition and Treatment Outcomes

William R. Miller, Ph.D., and J. Scott Tonigan, Ph.D.

ABSTRACT

A matching hypothesis within Project MATCH predicted better outcomes for clients low in problem recognition (as measured by the SOCRATES) when treated in Motivational Enhancement Therapy (MET), as compared with two other treatment approaches. SOCRATES scores, both before and after treatment, did reliably predict drinking outcomes during followup in both outpatient and aftercare arms of the trial. These prognostic relationships were observed in all three treatment conditions, and no support was found for the predicted matching effect. As predicted, aftercare clients in the MET condition did show significantly greater increases in problem recognition during treatment. Also as expected, initial motivation (recognition) predicted the quality of therapist-client working alliance in the other two treatments but not in MET, a finding observed in both arms of the trial. That is, MET appears to have removed the prognostic effect of pretreatment motivation on working alliance. The causal chain broke down, however, because neither change in problem recognition nor working alliance was reliably related to treatment outcomes. Taking Steps proved to be the most reliable predictor (among the SOCRATES scales) of treatment outcome. This is consistent with a larger literature showing that client action toward change (sometimes called adherence or compliance) is a robust predictor of more successful outcomes.

Project MATCH afforded an opportunity to test the prognostic properties of pretreatment motivation for change. The matching hypothesis regarding motivation was based on the University of Rhode Island Change Assessment (URICA) scale, a report of which is found elsewhere in this volume (DiClemente et al.). Because the items of the URICA are phrased in general terms for applicability to a broad range of possible problems, it seemed useful to determine whether more alcohol-specific motivation is predictive of treatment outcomes.

The Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES) was designed to query motivational aspects specific to problem drinking. Its initial item pool was constructed to sample stages of change as they may apply to drinking behavior, with items intended to correspond to the Precontemplation, Contemplation, Determination, Action, and Maintenance stages of the Transtheoretical Model (Prochaska and DiClemente 1986). In subsequent waves of factor analyses, however, we were unable to reproduce factors corresponding directly to these constructs. Instead, the SOCRATES consistently yields three factors with test-retest reliability and good cross-cultural and internal consistency (Miller and Tonigan 1996). The first of these scales, termed Recognition, contains items originally assigned to the Determination (loading positively) and Precontemplation (loading negatively) scales and seems to center around the drinker's awareness and acknowledgment of alcohol-

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related problems. A second factor, labeled Taking Steps, combines the Action and Maintenance items, all loading in the same direction, and reflects the drinker's prior and current efforts to change. Items from the Contemplation domain, as contained in the SOCRATES, form a separate third factor. These were written to capture uncertainty about alcohol problems within their sentence structure ("There are times when I wonder if I drink too much"), and the scale is termed Ambivalence. Given the observed difference in factor structure, names of the URICA stages and combination scales were specifically avoided so as not to suggest that the SOCRATES taps the same general constructs.

The Matching Hypothesis

Following logic similar to that for the motivation hypothesis, we reasoned that *less motivated clients would benefit differentially from the Motivational Enhancement Therapy (MET; Miller et al. 1992) as compared with MATCH's two more action-oriented treatments, Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992) or Twelve Step Facilitation (TSF; Nowinski et al. 1992).* A similar finding was reported by Heather and associates (1996) such that at earlier stages of readiness (precontemplation, contemplation), motivational interviewing was associated with better outcomes in comparison to behavioral skill training, whereas clients in action and maintenance stages showed similar responses to the two treatment methods.

Our original intention was to subtract the SOCRATES Precontemplation scale score from its Determination scale score, as a measure focused on earlier motivational stages. The discovered factor structure of the SOCRATES, while not corresponding to stages of change, fortunately did lend itself to the testing of this hypothesis because the Recognition factor manifests this difference score in its item loadings (original Determination items loading positively and Precontemplation negatively). Thus, the SOCRATES Recognition scale score was chosen as the matching variable. A difference in dependent variable slopes was hypothesized for MET versus the other two treatments, predicting a higher percentage of abstinent days and fewer drinks per drinking day in the MET condition at lower levels of alcohol problem recognition.

The Causal Chain

The SOCRATES Recognition interaction was expected because MET was designed specifically to address client motivation (including problem recognition), whereas the other approaches were more action oriented. Two core assumptions drove the causal model specified below. First, the MET condition would disrupt the normally strong prognostic effect of motivation on favorable outcome by raising awareness of alcohol-related problems among clients with low pretreatment motivation. Second, action-oriented therapies are intended for highly motivated clients, but low-motivation clients are disadvantaged when assigned to action-based therapy. This disadvantage was predicted to result in poorer working alliance and treatment outcomes in CBT and TSF. This effect was hypothesized to operate via a specified causal chain including the following assumptions:

- Higher motivation levels both before and after treatment will predict better outcomes.
- For clients initially low in problem recognition, MET will result in a greater increase in Recognition than will occur in CBT or TSF.
- Therefore, baseline level of problem recognition will be positively related to therapist working alliance in the combined CBT and TSF conditions but not in the MET condition.
- As a result, the prognostic effect of baseline problem Recognition on outcome will be stronger in the combined CBT and TSF groups relative to the MET condition.
- Better therapeutic working alliance will be related to end-of-treatment problem Recognition levels in MET, which in turn will influence drinking outcomes.

- The differential effect of MET on working alliance and/or on problem recognition will account for the predicted matching interaction of treatments with outcomes, such that clients low in Recognition will fare better in MET than in the combined CBT and TSF conditions.

Working alliance was determined through the Working Alliance Inventory (WAI; Horvath and Greenberg 1986), a brief self-report measure intended to assess client impressions of client-therapist therapeutic alliance. In Project MATCH, the WAI was generally administered after the second week of therapy, which most often corresponded to the end of the second therapy session. The WAI yields three scales and a total score, with higher scores indicating higher endorsement or agreement. The three scales were client impressions of client-therapist *bonding*, and client agreement with designated therapeutic *tasks* and *goals*.

Procedures for testing the final matching hypothesis, including use of covariates in the analyses and control of site, treatment, and matching variable interactions, have been described in detail elsewhere (Project MATCH Research Group 1997*a*; Longabaugh and Wirtz, this volume, pp. 4–17). Path analyses within treatment groups were used as the primary tool for testing links of the causal chain. As throughout Project MATCH, these analyses were conducted separately in the two arms (aftercare and outpatient) of the trial.

Results

Findings are presented separately for the aftercare and outpatient arms of the MATCH trial. Presented separately for each arm, findings first focus on the prognostic value of SOCRATES scores (including the matching variable, Recognition) on the two primary dependent measures during posttreatment months. Various strategies to aggregate daily drinking data were evaluated. Description of client drinking as during (months 1–3) and after (months 4–15) treatment has heuristic advantages, but post hoc analyses of monthly drinking during the 12 months of followup (months 4–15) substantially increase type-1 error rate. This concern is especially acute in the context of conducting causal chain analyses, where alternative choices of monthly values to evaluate proposed causal models may substantially alter findings. For these reasons, monthly values for these two dependent measures across the 12 months of followup were recalculated and divided into proximal followup (months 4–9) and distal followup (months 10–15).

This is followed by results of the formal tests of the matching hypothesis using hierarchical linear modeling (HLM). Finally, causal chain analyses are presented to clarify secondary HLM matching analyses, highlighting unanticipated aspects of the causal chain and showing how the purported mechanisms of the matching hypothesis varied by aftercare and outpatient study arms.

Outpatient Arm

Prognostic Effects of SOCRATES

Table 1 provides the most liberal interpretation of the prognostic value of the SOCRATES in predicting the two primary dependent variables in MATCH: percentage of days abstinent (PDA) and drinks per drinking day (DDD) at proximal and distal followups in the outpatient arm. Based upon transformed PDA and DDD measures, second-order partial correlations

Table 1. Prognostic main effect of SOCRATES scales on outpatient proximal and distal treatment outcome for both primary dependent measures [1]

SOCRATES scale	Proximal followup Months 4–9		Distal followup Months 10–15	
	PDA	DDD	PDA	DDD
Ambivalence	-.01	-.03	-.01	-.00
Recognition	.11*	-.10*	.11*	-.10*
Taking Steps	.21*	-.18*	.18*	-.17*

[1] Second-order partial correlations between SOCRATES scales and PDA and DDD, controlling for baseline PDA and DDD.
* $p<.05$

controlling for intake values of PDA and DDD, but not treatment condition, indicate that the Recognition and the Taking Steps scales significantly and positively predict PDA and DDD at both proximal and distal followup intervals. Clients higher in Recognition and Taking Steps at intake reported both higher rates of abstinence and less drinking intensity across followups. In contrast, Ambivalence scores were unrelated to frequency and intensity of drinking at both followup intervals.

Hierarchical multiple regression analysis (MRA) was used to examine the joint and unique contribution of the three SOCRATES scales in predicting PDA (proximal and distal), after controlling for baseline values of PDA and DDD, and for treatment main effects (effect coded). This approach was judged more conservative than the former because, unlike the partial analyses which did not control for treatment main effects, these analyses also discarded redundant variance among the three SOCRATES scales in predicting client drinking status. MRA results (N=866) indicated that, in combination, the three scales accounted for a significant increment in variance (4.5 percent) above that predicted by baseline values of PDA and DDD and treatment group assignment (11.5 percent), $F(3, 858)=15.24$, $p<.001$. Single degree of freedom (*df*) tests of the beta weights (β) showed, like the partial analyses, that Recognition (β= 0.07) and Taking Steps (β=0.19) were jointly and uniquely predictive of early followup PDA, whereas client ambivalence was unrelated to frequency of drinking. At distal followup, the three SOCRATES scales jointly added a significant increment in variance (3.5 percent) in PDA, above baseline drinking measures and treatment group assignment, $F(3, 835)=11.72$, $p<.001$. Single *df* tests indicated that pretreatment Taking Steps (β=0.16, $p<.001$) and Recognition (β=0.08, $p<.03$) again uniquely predicted distal PDA, while client pretreatment Ambivalence was unrelated to distal PDA.

A second wave of prognostic analyses included an HLM approach that controlled for the variables already described as well as site effects and matching variable by site and matching variable by treatment interactions. This analysis was conducted only for the Recognition scale, which was the matching variable. Here, and across the entire 12 months of followup, both PDA and DDD were significantly related to clients' Recognition scores such that higher self-reported problem recognition at baseline was associated with higher PDA ($p<.0001$) and lower DDD ($p<.014$).

Testing the Matching Hypothesis

Table 2 provides the unadjusted probability values (α=0.05) of the HLM tests of the recognition matching hypothesis reported in Project MATCH during (Project MATCH Research Group 1998) and after treatment (Project MATCH Research Group 1997*b*). Also included are pairwise treatment contrasts not predicted nor previously reported but provided as an aid to interpret how the Recognition matching variable may have unanticipated mediating effects.

Bonferroni-corrected HLM analyses using PDA did not support the a priori hypothesis when time was collapsed for the during ($p<.40$)

Table 2. Summary of outpatient HLM problem recognition matching tests: Probability values associated with tests of during and after treatment client-treatment matching

Variable	Predicted match	Unplanned matching contrasts		
	MET vs. CBT&TSF	CBT–MET	CBT–TSF	MET–TSF
During treatment				
PDA	.40	.55	.75	.38
PDA linear	.58	.76	.71	.51
PDA quadratic	.14	.12	.59	.32
DDD	.99	.87	.75	.88
DDD linear	.61	.97	.42	.41
DDD quadratic	.08	**.05**	.40	.27
After treatment				
PDA	.52	.69	.74	.48
PDA linear	**.04**	**.04**	.70	.11
PDA quadratic	.15	.93	.22	.21
DDD	.72	.73	.96	.78
DDD linear	.65	.81	.20	.31
DDD quadratic	.53	.17	.11	.82

or posttreatment ($p<.52$) phases of the trial. Tests of the predicted matching effect when the contrast was examined across time as a linear or as a quadratic function likewise did not support the hypothesis during ($p<.58$, linear; $p<.14$, quadratic) or after treatment ($p<.04$, linear; $p<.15$, quadratic). None of the post hoc monthly contrasts supported the prediction that clients with lower intake recognition fared better (higher PDA) in the MET condition relative to low-recognition clients assigned to the combined CBT and TSF conditions. Figure 1 depicts the general relationship tested in the HLM analyses, and one can see the modestly prognostic effect of client recognition but the absence of a statistically significant and/or clinically relevant differential relationship between recognition and PDA by treatment condition at proximal followup. Probability values (α) associated with the unplanned paired contrasts in table 2 likewise indicate that problem recognition did not mediate treatment response in regard to PDA during or after treatment.

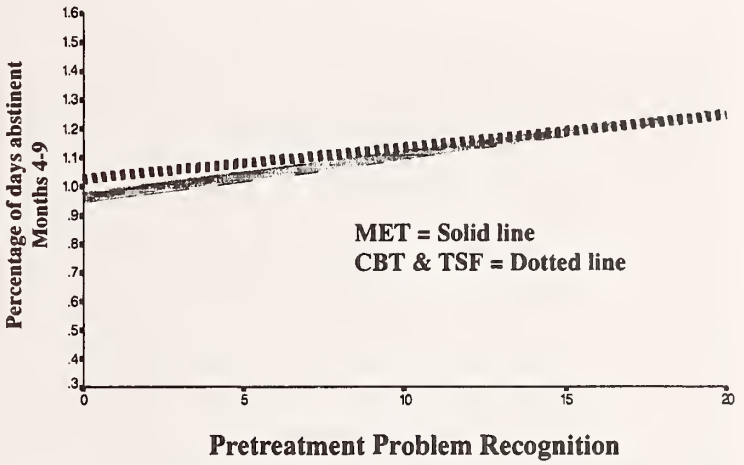

Figure 1. Pretreatment Problem Recognition and proximal percentage of days abstinent in the outpatient sample: A priori matching hypothesis

Parallel HLM analyses using drinking intensity (DDD) also failed to support the problem recognition hypothesis when time was collapsed during ($p<.99$) and after treatment ($p<.72$). When the contrast was modeled across months in linear or quadratic functions, no support was found either during ($p<.61$, linear; $p<.08$, quadratic) or after treatment ($p<.04$, linear; $p<.53$, quadratic) after Bonferroni correction for the two primary dependent measures ($\alpha=0.05/2$). None of the post hoc monthly contrasts supported the a priori prediction. Unplanned pairwise treatment contrasts also failed to indicate a problem recognition mediation effect.

Causal Chain Analyses

Figure 1 highlights one faulty assumption about the change mechanisms predicted to operate in the MET and combined CBT and TSF conditions. Inconsistent with our predication, the prognostic effect of client Recognition at intake was *not* stronger in the combined CBT and TSF conditions. This section examines the factors that may explain this breakdown in the Recognition matching hypothesis.

Figure 2 presents the standardized coefficients (β) for the separate path analyses for the MET and combined CBT and TSF conditions in the outpatient sample. Site effects were partialed out from all relationships shown in these figures. As predicted, pretreatment Recognition was significantly and positively related to therapist working alliance in the combined CBT and TSF conditions but not in the MET condition. Unexpectedly, therapeutic working alliance was not related to end-of-treatment problem Recognition in *any* group. Here, we anticipated positive relationships, with a significantly more positive relationship in the MET condition. We predicted a strong and positive relationship between pretreatment and end-of-treatment Recognition in the CBT and TSF condition, and a smaller relationship between these variables in the MET condition. This prediction was not supported. Finally, in the MET group, pretreatment Recognition was equally (if not more) prognostic of PDA and DDD both at proximal and distal followups as it was in the combined CBT and TSF groups. This finding is contrary to the prediction in our causal model.

The path analyses do not answer whether the corresponding slopes for the MET and the combined CBT and TSF conditions were statistically different from one another. These slope contrasts were accomplished using factorial MANCOVA. Here, variables specified in the

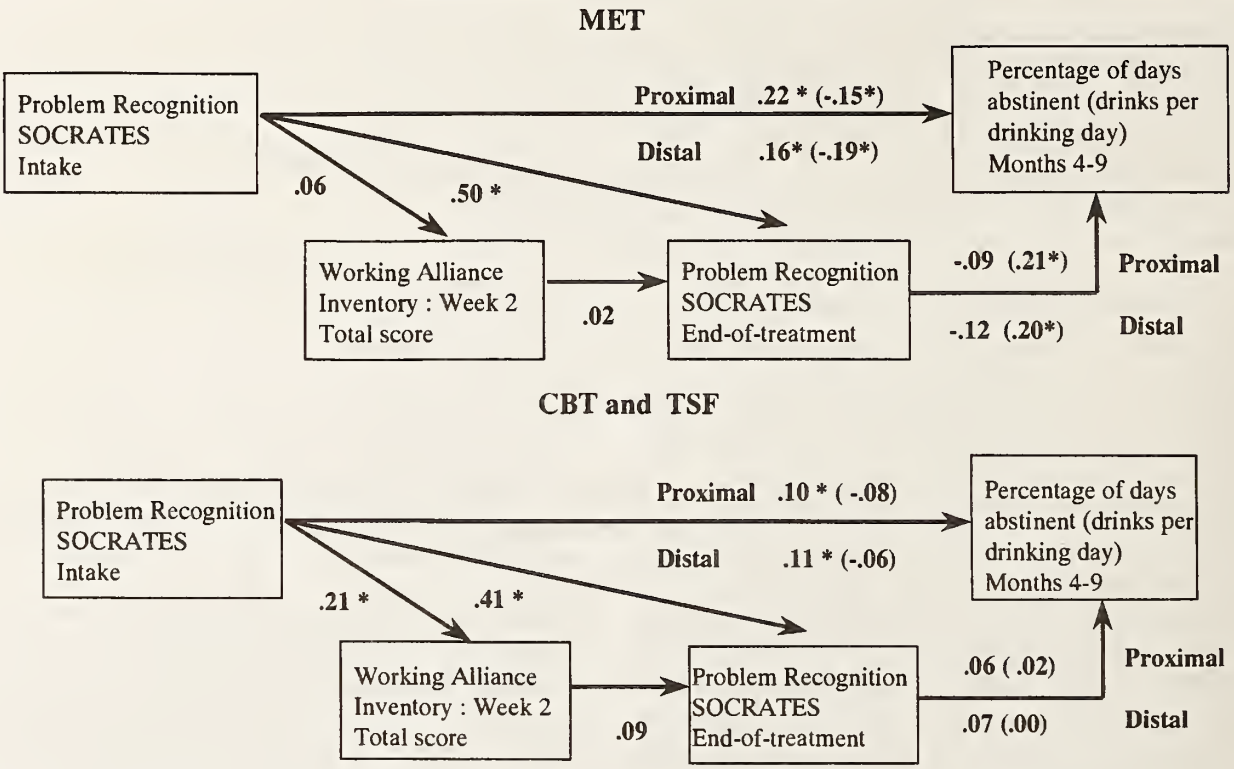

Figure 2. Outpatient Problem Recognition causal chain findings. Standardized coefficients are provided for proximal (above line) and distal (below line) followups. Results of regressing percentage of days abstinent on the Recognition measures (intake and end of treatment) are reported without parentheses, and results of regressing drinks per drinking day on the Recognition measures are reported in parentheses. *p<.05

causal chain (e.g., working alliance and end-of-treatment Recognition) were separately treated as dependent measures with pretreatment Recognition scores treated as a covariate. Standard tests of the homogeneity of regression coefficients (product term) indicated whether a differential relationship was present between Recognition and a causal variable when nested within treatment conditions. Also included as covariates in the analyses were baseline drinking (PDA and DDD), site, treatment, and pretreatment Recognition main effects. Because of the importance of the therapeutic working alliance construct to the matching hypothesis, these finer grained slope contrasts were conducted separately for each of the two subscales as well as the total score of the WAI. In addition, one variable representing client satisfaction with treatment was included in these analyses for exploratory purposes.

Table 3 summarizes slope contrast findings. A reported significant interaction in the column labeled interaction with Recognition indicates that the relationship between client pretreatment Recognition and the causal chain variable differed reliably between MET and CBT plus TSF. Unstandardized slope coefficients below the columns headed MET and CBT plus TSF can be interpreted as describing the direction of the relationship of interest within the two treatment modalities. As our model predicted, pretreatment Recognition was significantly and differentially related to therapeutic working alliance by treatment condition. Pretreatment Recognition was unrelated to client report of alliance of treatment Goal and Task or to the total WAI score in MET. However, in the combined CBT and TSF conditions, pretreatment Recognition was significantly and positively related to the two WAI scales and the total WAI score.

No difference in slopes was found, however, for the treatment group nested relationship between pretreatment and end-of-treatment Recognition. The predicted situation wherein

Table 3. Slope contrasts in the a priori causal chain model: Problem Recognition in the outpatient sample

Causal chain variable	Interaction with Recognition	MET	CBT and TSF
WAI week-2 Goal	p<.04	.05	.19
WAI week 2 Task	p<.02	.03	.20
WAI week 2 total score	p<.02	.04	.19
End-of-treatment Recognition	p<.83	.43	.48
General satisfaction with treatment	p<.03	.07	-.09

NOTE: Coefficients are unstandardized.

before and after treatment Recognition would be more strongly related in the combined CBT and TSF conditions was not realized. Unplanned slope contrasts indicated that client satisfaction with treatment (collected at week 12) was significantly and differentially related to pretreatment Recognition by treatment condition. Specifically, higher pretreatment problem recognition was modestly and negatively related to satisfaction with treatment in the CBT and TSF conditions. A modest and positive relationship between treatment satisfaction and pretreatment Recognition was obtained in the MET condition.

Slope analyses indicated several faulty assumptions in our predicted model in the outpatient sample. The next step therefore was to assess how, if at all, problem recognition changed during treatment. Table 4 provides the difference scores on the three SOCRATES scales between intake and end of treatment. In the ideal situation, and in both study arms, we predicted that Recognition would increase significantly more during treatment for clients assigned to MET. Heightened problem recognition was presumed, in turn, to improve treatment outcome. The basic assumption of increased gains in Recognition in the MET condition was not supported, and gains in Taking Steps to achieve abstinence actually was higher in the action-oriented CBT and TSF conditions ($p<.05$). The third and last columns in table 4 show identically calculated difference scores, but only for those clients at intake with the lowest Recognition scores (lowest third of the distribution). Presented as a purer test of our assumptions, independent t-tests indicated that changes in motivation during treatment did not vary between MET and combined CBT and TSF on any of the three SOCRATES scales for low-Recognition clients assigned to MET versus CBT or TSF.

Did changes in client motivation *during treatment* significantly add to prediction of proximal and distal PDA and DDD beyond that of pretreatment motivation? Using hierarchical multiple regression, and separately regressing proximal and distal PDA and DDD (four regressions), we entered baseline values of the two primary dependent measures (PDA and DDD), site effects, and treatment main effects. Baseline measures of client Ambivalence, Recognition, and Taking Steps were then entered. Finally, and of primary interest, the three SOCRATES scales collected at 3 months (*end of treatment*) were entered into the model. The 3-month SOCRATES measures accounted for a significant increment in variance above that associated with the baseline motivation measures for

Table 4. Mean (SD) comparison of pretreatment and end-of-treatment SOCRATES motivational scales: Difference scores by matching hypothesis for full and restricted outpatient samples

SOCRATES scale	Full sample		Lowest third in distribution	
	MET	CBT and TSF	MET	CBT and TSF
Ambivalence	.14 (.35)	.15 (.35)	.10 (.30)	.15 (.35)
Recognition (MV)	2.60 (4.96)	2.48 (5.42)	.33 (4.02)	.29 (5.99)
Taking steps	2.25 (6.92)	3.42 (6.63)*	2.14 (5.19)	3.56 (7.15)

MV=matching variable
* $p<.05$

both proximal PDA (17-percent increment, $F(3, 790)=70.64$, $p<.001$) and proximal DDD (17 percent, $F(3, 790)=59.91$, $p<.001$). Separate t- tests of slope coefficients indicated that all three measures of motivation collected at 3-month followup—on both PDA and DDD—added significantly and uniquely ($p<.05$) to prediction of the frequency and intensity of proximal drinking, with the Taking Steps scale accounting for the largest unique contribution ($\beta=0.42$ for PDA and $\beta=-0.41$ for DDD).

At distal followup, changes during treatment in recognition accounted for a significant increment in PDA beyond that associated with pretreatment SOCRATES Recognition scales (8 percent, $F(3, 768)=26.86$, $p<.001$) and in DDD (11 percent, $F(3, 768)=33.45$, $p<.001$). For the distal PDA measure, change in Ambivalence was significantly and negatively predictive ($\beta=-0.11$, $p<.002$), and change in Taking Steps was positively and significantly predictive ($\beta=0.26$, $p<.001$). Changes in problem recognition were unrelated to frequency of drinking at distal followup. For the distal DDD measure, problem recognition was not predictive, while changes in Ambivalence ($\beta=0.14$, $p<.001$) and Taking Steps ($\beta=-0.30$, $p<.001$) uniquely predicted drinking intensity.

Aftercare Arm

Prognostic Effects of SOCRATES

The second-order partial correlations in table 5 for the aftercare arm suggest that clients' pretreatment Recognition was mostly unrelated to PDA and DDD at both proximal and distal followups, the one exception being a small but significant negative relationship between Recognition and drinking intensity during early followup. A more consistent pattern with the aftercare arm was found for the Taking Steps scale. Specifically, both PDA and DDD were significantly predicted by this scale at both followups.

The more conservative hierarchical multiple regression analysis ($N=693$) approach indicated that the three SOCRATES scales jointly contributed a significant increment in variance (2.0 percent) in proximal PDA above that attributable to the baseline drinking measures and

Table 5. Prognostic main effect of SOCRATES scales on aftercare proximal and distal treatment outcome for both primary dependent measures [1]

SOCRATES scale	Proximal followup Months 4–9		Distal followup Months 10–15	
	PDA	DDD	PDA	DDD
Ambivalence	.04	-.10*	.02	-.03
Recognition	.07	-.09	.07	-.07
Taking steps	.13*	-.15*	.12*	-.13*

[1] Second-order partial correlations between SOCRATES scales and PDA and DDD, controlling for baseline PDA and DDD
* $p<.05$

treatment assignment (3.3 percent), $F(3, 685)=4.89$, $p<.002$. Single df tests showed that only the Taking Steps scale ($\beta=0.13$, $p<.001$) uniquely predicted PDA at early followup after controlling for the remaining SOCRATES scales and baseline PDA, DDD, and treatment assignment.

At distal followup, the three SOCRATES scales again added a significant increment in variance, accounted for in the PDA measure (3.0 percent), $F(3,667)=3.53$, $p<.02$. Single df tests indicated that the Taking Steps measure alone and uniquely predicted distal PDA ($\beta=0.11$, $p<.01$). In the HLM analyses, which controlled for site effects and first-order interactions of Recognition with treatment and sites, no prognostic effect of the Recognition scale was identified with PDA ($p<.57$) nor with DDD ($p<.90$) across the entire 12-month followup interval.

Testing the Matching Hypothesis

Table 6 presents the unadjusted probability values ($\alpha=0.05$) of the HLM tests of the Recognition matching hypothesis reported in Project MATCH corporate papers (Project MATCH Research Group 1997*b*). Unplanned pairwise treatment contrasts are again provided as an aid to interpret how the Recognition matching variable may have unanticipated mediating effects.

Table 6. Summary of aftercare HLM Problem Recognition Matching tests: Probability values associated with tests of during and after treatment client-treatment matching

Variable	Predicted match	Unplanned matching contrasts		
	MET vs. CBT&TSF	CBT–MET	CBT–TSF	MET–TSF
During treatment				
PDA	.10	.14	.93	.19
PDA linear	.41	.25	.43	.76
PDA quadratic	.54	.44	.66	.77
DDD	.08	.23	.49	.07
DDD linear	.19	.16	.63	.40
DDD quadratic	.55	.37	.49	.87
After treatment				
PDA	.76	.56	.56	.97
PDA linear	.83	.63	.59	.93
PDA quadratic	**.005**	**.04**	.41	**.006**
DDD	.63	.65	.96	.71
DDD linear	.69	.49	.54	.98
DDD quadratic	**.04**	.11	.62	**.05**

No support was found for the Recognition matching hypothesis when time was collapsed during treatment ($p<.10$) or after treatment ($p<.76$). With time modeled, no linear function across monthly PDA values was found during ($p<.41$) or after treatment ($p<.83$). A significant Recognition contrast by quadratic interaction ($p<.005$), however, was found using monthly PDA as the dependent measure. Contrary to prediction, post hoc monthly contrasts indicated that low-recognition clients assigned to the MET condition tended to drink *more* frequently than low-recognition clients assigned to the combined CBT and TSF groups during months 4 and 5, $p<.01$ and $p<.05$, respectively. This finding is depicted in figure 3 where, in proximal followup, the largest slope differences were during the first few months of early followup. No differences were found in monthly PDA values for high-recognition clients assigned to MET and the combined CBT and TSF group.

Replicating the HLM analyses using the drinking intensity measure (DDD) yielded similar findings. Specifically, the recognition contrast was not significant when time was collapsed during ($p<.08$) or after treatment ($p<.63$) nor when the contrast was modeled across time as a linear function during ($p<.19$) or after treatment ($p<.69$). In a quadratic context, however, the recognition contrast was significant ($p<.04$), and monthly tests showed that low-recognition clients assigned to the MET condition tended to drink significantly more alcohol per drinking occasion than low-recognition clients in CBT and TSF in the first month after the end of treatment (month 4, $p<.02$). This difference quickly faded, however, and no differences were found between high-recognition clients assigned to the different treatments.

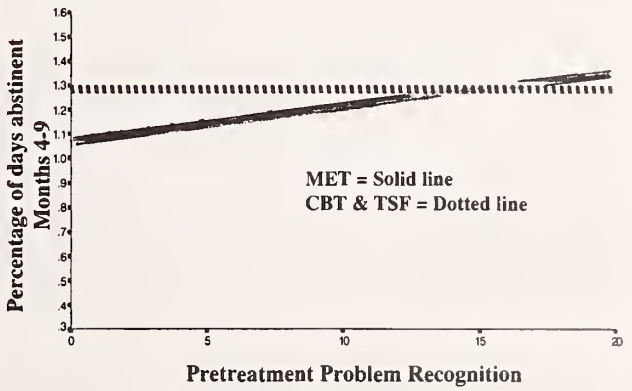

Figure 3. Pretreatment Problem Recognition and proximal percentage of days abstinent in the aftercare sample: A priori matching hypothesis

Causal Chain Analyses

Contrary to our prediction, figure 4 shows a prognostic effect of pretreatment problem recognition in the MET condition and no prognostic effect of recognition in the combined CBT and TSF conditions. The proposed causal model was the same for aftercare and outpatient samples and is not repeated here.

Figure 4 shows the standardized coefficients (β) for the two path analytic models in the aftercare sample. All relationships of interest controlled for site effects. As predicted, pretreatment Recognition score was not predictive of therapeutic working alliance collected at Week

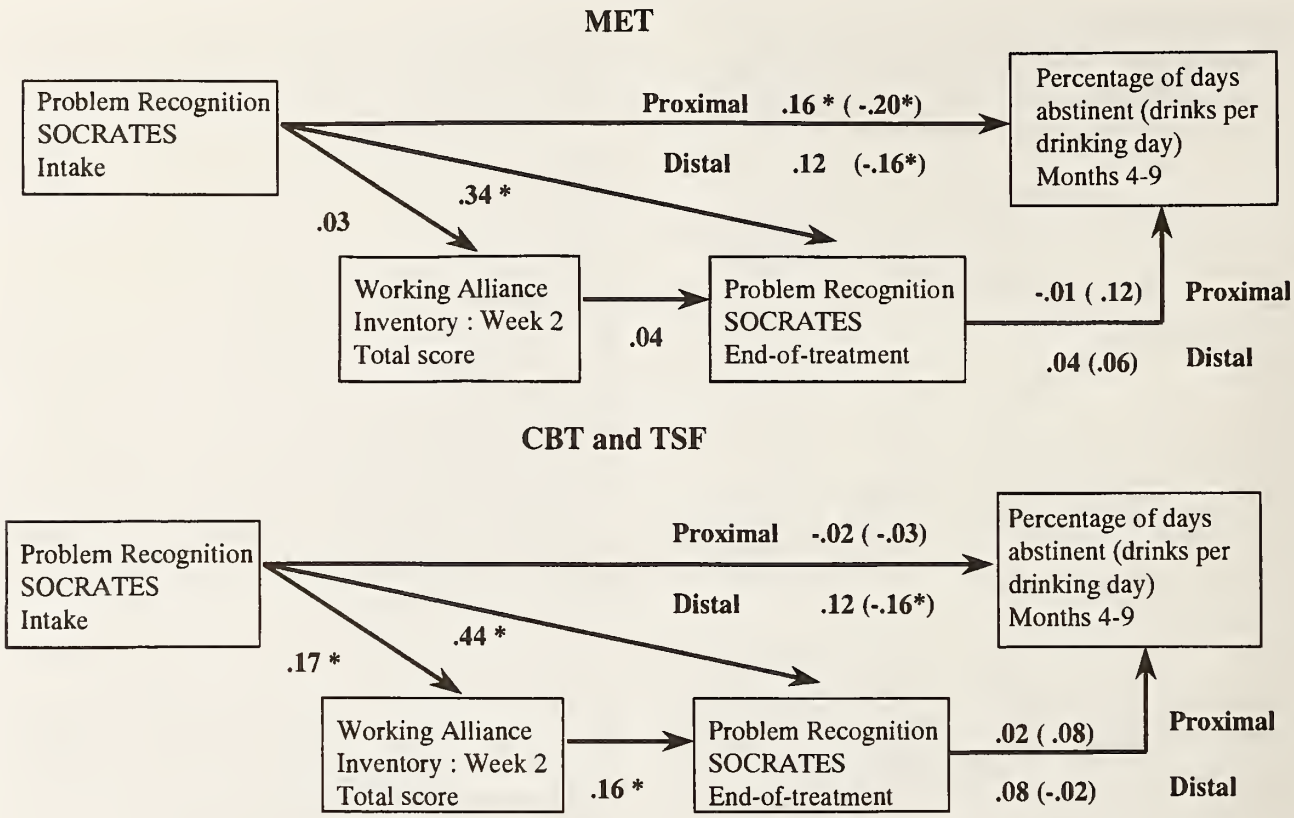
MET
Problem Recognition SOCRATES Intake
Proximal .16 * (-.20*)
Distal .12 (-.16*)
Percentage of days abstinent (drinks per drinking day) Months 4-9
.34 *
.03
Working Alliance Inventory : Week 2 Total score
.04
Problem Recognition SOCRATES End-of-treatment
-.01 (.12) Proximal
.04 (.06) Distal
CBT and TSF
Problem Recognition SOCRATES Intake
Proximal -.02 (-.03)
Distal .12 (-.16*)
Percentage of days abstinent (drinks per drinking day) Months 4-9
.44 *
.17 *
Working Alliance Inventory : Week 2 Total score
.16 *
Problem Recognition SOCRATES End-of-treatment
.02 (.08) Proximal
.08 (-.02) Distal

Figure4. Aftercare Problem Recognition causal chain findings. Standardized coefficients are provided for proximal (above line) and distal (below line) followups. Results of regressing percent days abstinent on the Recognition measures (intake and end of treatment) are reported without parentheses, and results of regressing drinks per drinking day on the Recognition measures are reported in parentheses. *p<.05

2 in the MET condition. Opposite to our predictions, pretreatment recognition for MET clients was significantly and positively related to end-of-treatment problem recognition, indicating that MET did not alter a client's relative standing in the before and after treatment motivational distributions. Also, contrary to our predictions, therapeutic working alliance at Week 2 was unrelated to end-of-treatment problem recognition in the MET group. Finally, our prediction that the prognostic value of pretreatment recognition on PDA and DDD would be mitigated at proximal and distal followups in the MET condition was not supported.

In most aspects, the path analysis models were quite similar for the aftercare and outpatient MET conditions. Where the path analysis findings *differed* from outpatient to aftercare arms is in findings for the CBT and TSF conditions. As predicted for the MET conditions, pretreatment recognition was not predictive of proximal or distal PDA and DDD. Uniquely, aftercare CBT and TSF clients were the only ones who, as a group, reported a positive and significant relationship between therapeutic working alliance at week 2 and end-of-treatment problem recognition. This relationship had been predicted to occur only in the MET condition. Consistent with our predictions, and similar to the outpatient CBT and TSF conditions, a significant and positive relationship was found between pretreatment recognition and Week-2 therapeutic working alliance.

Factorial MANCOVA was used to conduct formal statistical contrasts of corresponding slopes illustrated in the two aftercare path models. The rationale and analytical approach to these contrasts were described in the outpatient causal chain analyses and are not repeated. Table 7 presents the probability values

Table 7. Slope contrasts in the a priori causal chain model: Problem recognition in the aftercare sample

Causal chain variable	Interaction with Recognition	MET	CBT and TSF
WAI week-2 Goal	p<.05	.02	.18
WAI week-2 Task	p<.13	.04	.18
WAI week-2 total score	p<.05	.02	.19
End-of-treatment Recognition	p<.31	.32	.46
General satisfaction with treatment	p<.67	.07	.03

NOTE: Coefficients are unstandardized.

(α) associated with the test of a differential relationship between a causal chain variable and pretreatment Recognition by treatment condition, labeled Interaction with Recognition. As predicted, pretreatment recognition was differentially related with Week-2 therapeutic working alliance, contingent upon treatment assignment. In the MET condition, as predicted, pretreatment recognition was not predictive of therapeutic relationship, whereas Recognition score was significantly and positively related to goal and total working alliance in the CBT and TSF conditions. No difference, however, was observed between treatment groups in the relationship between pretreatment and end-of-treatment problem recognition. Here, MET and combined CBT and TSF groups both reported significant and positive associations between before and after treatment Recognition scores. Pretreatment problem recognition was not differentially related by treatment condition with client satisfaction with treatment.

Analyses indicated several points at which therapeutic change mechanisms did not differentially relate to the motivation matching variable. An important related question is whether the matching variable itself changed as predicted during treatment. One of the core assumptions of the recognition hypothesis was that the motivational focus of the MET condition would produce greater gains in Recognition and Taking Steps scores relative to the CBT and TSF conditions. Also implied was that MET would be associated with a greater decline in Ambivalence about change relative to the CBT and TSF conditions.

Table 8 presents the pretreatment and end-of-treatment difference scores for the three SOCRATES scales. Difference scores were computed by subtracting pretreatment from end-of-treatment scores. Positive difference scores therefore suggest an increase in the measured attribute. As predicted, significantly greater gains in recognition of alcohol problems were made in the MET condition relative to the CBT and TSF conditions ($p<.05$). Unexpectedly, Taking Steps scores declined during the 12 weeks of treatment, with no group differences observed in the magnitude of this decline. Ambivalence about change remained relatively stable from the beginning to end of treatment, with no treatment effect observed.

The third and fourth columns in table 8 compare before/after changes in SOCRATES scores for that portion of the aftercare sample with the lowest third of scores in the pretreatment Recognition distribution. This comparison is

Table 8. Mean (SD) comparison of pretreatment and end-of-treatment SOCRATES motivational scales: Difference scores by matching hypothesis for full and restricted aftercare samples

SOCRATES scale	Full sample		Lowest third in distribution	
	MET	CBT and TSF	MET	CBT and TSF
Ambivalence	.12 (.33)	.11 (.32)	.09 (.29)	.16 (.37)
Recognition (MV)	3.65 (5.98)	2.47 (4.97)*	1.33 (6.37)	.77 (5.40)
Taking Steps	-.61 (5.98)	-.35 (5.80)	-.44 (4.87)	1.22 (.06)

MV=matching variable
* p<.05

regarded as a purer test of the motivational impact of MET. Here, no mean differences were observed between the two comparison groups on any of the three SOCRATES scales.

Four hierarchical multiple regressions were conducted to examine if before/after *changes* in the three SOCRATES scales predicted proximal and distal PDA and DDD after controlling for site and treatment effects as well as baseline drinking (PDA and DDD) and SOCRATES scores. Three-month SOCRATES scales accounted for a significant increment in variance in both proximal PDA (13 percent, $F(3, 605)= 34.07$, $p<.001$) and DDD (11 percent, $F(3, 605)= 27.32$, $p<.001$). Problem recognition was not predictive of proximal PDA ($p<.26$) after controlling for baseline problem recognition. Three-month Taking Steps ($\beta=0.37$, $p<.001$) and extent of Ambivalence ($\beta=-0.14$, $p<.01$), however, uniquely predicted proximal PDA after controlling for baseline values. Regarding drinking intensity, all three SOCRATES scales uniquely and significantly predicted consumption patterns, with the Taking Steps scale ($\beta=-0.34$, $p<.001$) uniquely accounting for the bulk of variance in DDD.

End-of-treatment motivation scales added significant variance in the prediction of distal abstinence (6 percent, $F(3, 590)=13.01$, $p<.001$) and drinking intensity (5 percent, $F(3, 590)=12.23$, $p<.001$) beyond that offered by baseline motivation alone. End-of-treatment Recognition score was not predictive of either the frequency (PDA) or intensity (DDD) of alcohol consumption after controlling for baseline measures. Ambivalence about change at the end of treatment was negatively and significantly predictive of distal frequency of abstinent days ($\beta=-0.11$, $p<.01$) and positively and significantly predictive of distal drinking intensity ($\beta= 0.12$, $p<.006$) after controlling for baseline measures. End-of-treatment Taking Steps was a strong predictor of distal alcohol consumption after controlling for pretreatment motivation. Here, Taking Steps was positively related with distal abstinence ($\beta=0.23$, $p<.001$) and significantly and negatively predictive of drinking intensity ($\beta=-0.22$, $p<.001$).

Did We Choose the Wrong Scale?

The Recognition matching hypothesis was not supported in either the aftercare or the outpatient study, and causal chain analyses were only partially supported. Causal chain analyses highlighted the complex and poorly understood nature of readiness for change and how motivation for change influences and is influenced by the active ingredients of therapy. Especially important is gaining a better understanding of how the dimensions of motivation relate to one another, and how these relationships change across time. Figure 5, for example, shows the relationship between Recognition and Taking Steps before-and-after difference scores by study arm. Rationally, one would expect in a treatment-seeking population—and for clients actually engaged in therapy—a strong positive relationship between gains in awareness of problems and taking actions to eliminate these problems. This was the case for aftercare clients, but much less so for clients recruited in the outpatient sample. Why might this be so?

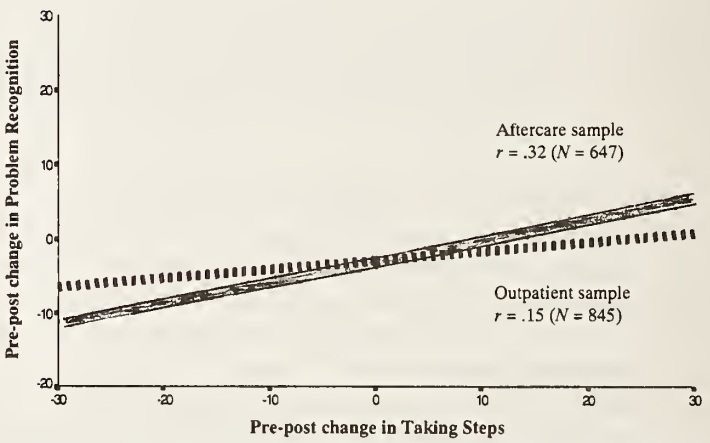

Figure 5. Relationship between pre-post change in Problem Recognition and Taking Steps by Project MATCH study arm

Analyses suggested that Taking Steps is prognostic of positive outcome, and in most cases, a stronger indicator of success than Recognition. We wondered whether the SOCRATES Taking Steps scale might be a client matching variable worthy of attention. To this end, we replicated most analyses reported

scale as the matching motivation variable. Classical multivariate repeated-measures analyses failed to support the Taking Steps matching hypothesis (same predictions as for Recognition) on either primary dependent measure.

The four Taking Steps path-analysis models differed from the Recognition models in two key respects. First, significant positive relationships were obtained between working alliance at Week 2 and end-of-treatment Taking Steps in all four models (r's=0.20, 0.19, 0.17, and 0.22). With the Recognition matching variable, this positive relationship was only present in the CBT and TSF aftercare conditions. Second, end-of-treatment Taking Steps was a significant predictor of both proximal and distal outcome, while the end-of-treatment Recognition measure partially predicted proximal outcome but generally failed to predict distal outcome reliably.

Table 9 shows the core slope contrasts in the causal chain model with the Taking Steps scale used as the motivational matching variable. Findings for the outpatient and aftercare samples are combined into a single table. Unlike the Recognition scale, product terms indicated that the relationship between pretreatment Taking Steps and the working alliance variables and end-of-treatment Taking Steps did not differ between MET and the combined CBT and TSF. In agreement with the path models using Taking Steps as the matching variable, strong positive relationships were found regardless of treatment assignment.

Table 9. Slope contrasts in the post hoc causal chain analysis: SOCRATES Taking Steps as the matching variable in the total sample

Variable	Interaction with Taking Steps	MET	CBT and TSF
Outpatient sample			
WAI week-2 Goal	$p<.25$	.08	.19
WAI week-2 Task	$p<.36$	.11	.22
WAI week-2 total score	$p<.42$	.12	.22
End-of-treatment Taking Steps	$p<.83$	.17	.30
Aftercare sample			
WAI week-2 Goal	$p<.28$	.06	.19
WAI week-2 Task	$p<.25$	.06	.19
WAI week-2 total score	$p<.33$	.07	.18
End-of-treatment Taking Steps	$p<.31$	.21	.25

NOTE: Coefficients are unstandardized.

Discussion

The rationale for the predicted matching effect was that MET would differentially benefit clients with lower pretreatment levels of problem recognition by enhancing their motivation for change. Where did the hypothesis fail? Some early components of the predicted causal chain were confirmed, but later links were not. We did find the expected prognostic effect of pretreatment SOCRATES scores on treatment outcomes, but it occurred regardless of treatment assignment. Problem Recognition predicted both PDA and DDD throughout followup, but only among outpatients. The Taking Steps subscale score, in contrast, predicted both outcome measures throughout followup in both arms of the trial. The more a client had already been taking steps toward change before beginning treatment, the better the outcomes.

Similarly, clients' posttreatment motivation scores on SOCRATES were significantly predictive of both outcome measures at both proximal and distal followup intervals in both arms of the trial, even after removing variance accounted for by baseline drinking and motivation measures, treatment groups, and sites. Effects of change in Recognition were inconsistent, but in both arms of the trial, better outcomes on both dependent measures were consistently related to greater increases in Taking Steps and decreases in Ambivalence. That is, when treatment was associated with increased motivation (less ambivalence and more taking steps), outcomes were better throughout followup.

MET also showed a few of the predicted differential effects on intermediate variables. As

expected, pretreatment Recognition scores predicted therapeutic alliance only in the CBT and TSF conditions and not in MET. That is, MET appeared to obviate the relationship between low problem recognition and poor working alliance that was observed in the action-oriented treatments. In the aftercare arm, change in problem recognition also occurred only in MET and not in CBT and TSF. The problem is that these intermediate variables, while differentially affected by MET, did not significantly influence drinking outcomes, and that is where the causal chain broke down.

So where does this leave us? Our findings do support the importance of motivation as at least a predictor, if not a determinant, of drinking outcomes. The Taking Steps score, both prior to and after treatment, was a good predictor of outcomes. In analyses from another multisite outcome study (Miller et al. 1996), we similarly found that Taking Steps toward change, as measured by the SOCRATES, was a strong predictor of continued improvement (rather than relapse) among alcoholics.

This is consistent with a larger literature linking higher client adherence or compliance to better outcomes (e.g., Pettinati et al. 1996; Robson et al. 1965; Fiorentine and Anglin 1996). Similarly, the degree of attendance or involvement in Alcoholics Anonymous is predictive of more favorable outcomes (Emrick et al. 1993; Montgomery et al. 1995). Even compliance with placebo medication has been found to predict more favorable treatment outcomes (e.g., Fuller et al. 1986). It appears that clients' *doing something* toward change is a reliable predictor of better outcome.

The other measure of motivation in Project MATCH (URICA, DiClemente et al., this volume) also proved to be a good predictor of outcomes. It also appears to be the case that the more client motivation improves during treatment (on all three SOCRATES scales), the better the prognosis. Changes in motivation predict later changes in behavior.

An unanswered question is how this occurs, and more specifically, why Motivational Enhancement Therapy works at all (Miller 1998). Even a single session of motivational interviewing has been found to improve substance abuse treatment outcomes substantially (e.g., Bien, Miller, and Boroughs 1993; Brown and Miller 1993; Saunders et al. 1995), and brief interventions more generally have been shown to trigger behavior change when offered as stand-alone treatments (Bien, Miller, and Tonigan 1993). Clinical descriptions of motivational interviewing have emphasized impact on cognitive/affective variables such as problem recognition, ambivalence, distress, and discrepancy (Miller 1983; Miller and Rollnick 1991), and findings from this study support that emphasis. Yet an intervention designed specifically to have impact on these variables largely failed to do so differentially.

This indicates a further need to separate prognostic from causal and intervention effects in clinical research. Motivational variables such as self-efficacy, alcohol expectancies, problem recognition, and readiness have been shown to predict outcomes. It does not necessarily follow, however, that interventions designed to act upon these variables will thereby improve outcomes. Data from both Project MATCH (reported here) and a prior multisite study (Miller et al. 1996) question the mediating role of such cognitive variables and point instead to a key role of action and coping strategies. This would suggest that a treatment may succeed to the extent that it engages and retains clients in active personal efforts toward change.

In a prior study (Miller et al. 1996), we found that self-efficacy and other motivational variables did not contribute to variance accounted for in predicting relapse, once coping skills had been taken into account. It is possible that motivational variables to which causal importance has been attributed may represent instead more passive reflections of behavioral coping skills. In any event, the causal mechanisms underlying the efficacy of motivational interventions remain to be explicated.

Acknowledgment

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Self-Efficacy as a Matching Hypothesis: Causal Chain Analysis

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ABSTRACT

One of the matching hypotheses included in the Project MATCH trial involved Bandura's concept of self-efficacy. Client efficacy to abstain from drinking was hypothesized to interact with the three MATCH treatments. Clients low in efficacy would do better in Cognitive-Behavioral Coping Skills Therapy (CBT) than in Motivational Enhancement Therapy (MET), with those high in efficacy doing better in MET than in Twelve Step Facilitation (TSF). However, those highly tempted to drink (i.e., those with high temptation to drink and low self-efficacy to abstain) would do better in TSF compared to those in MET. In the aftercare arm, low efficacy clients in CBT showed drinking outcomes superior to those in MET during the period of treatment, but these differences did not persist into the followup period. For highly tempted individuals, TSF demonstrated more abstinence than MET during the first few weeks of the treatment period but not during the followup period. These interaction effects on drinking during treatment in the aftercare arm were the only hypothesized matching contrasts that were supported. Analyses of the assumed causal mechanisms indicated that some interactions between the treatments and changes in self-efficacy over time supported aspects of the matching effects in the aftercare arm. However, overall, there was little support for treatment-specific effects on efficacy or treatment interactions with efficacy. Pretreatment self-efficacy was predictive of posttreatment drinking for outpatients but not for aftercare clients and predicted amount of drinking at the 3-year followup for these outpatients. Both for outpatient and for aftercare, clients' abstinence self-efficacy assessed immediately posttreatment predicted client drinking during the 1-year followup period. Self-efficacy was distinct from measures of motivation, peaked during treatment, remained stable during followup, and played an important and interesting role in the cessation of drinking.

Self-efficacy is a construct developed by Bandura (1986) as a central element of his Social Cognitive Theory. Self-efficacy is a personal evaluation of the ability of an individual to perform a target behavior and differs from outcome expectancies, which involve expectations of the effects or consequences of performing the target behavior. Self-efficacy is assumed to influence motivation, information processing, personal effort, and thus, effective action. Various naturally occurring and treatment-specific activities and experiences are thought to influence levels of self-efficacy.

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Mastery experiences involving the target behavior are theorized to most strongly influence self-efficacy, followed by vicarious experience (modeling), verbal persuasion, and emotional arousal. Thus, self-efficacy is assumed to be a changeable, state variable associated with and predictive of specific behavior change.

Self-efficacy has long been considered a theoretically relevant construct for alcoholism treatment and recovery (DiClemente 1986; Marlatt and Gordon 1985; Rollnick and Heather 1982). In Marlatt and Gordon's (1985) Relapse Prevention model, efficacy to cope with high-risk situations is a central component of their conceptualization of the relapse process. Alcohol researchers have developed instruments to measure efficacy for coping with or resisting the urge to drink heavily (Annis 1986; Annis and Davis 1989) and efficacy to abstain from drinking (DiClemente et al. 1994) across a variety of high-risk relapse situations previously identified by Marlatt and colleagues. In order to evaluate the saliency or importance of these situations, many instruments include separate ratings of either the frequency or occurrence of these high-risk situations or the individual's temptation to drink in these situations (DiClemente et al. 1995).

Previous research has found that self-efficacy evaluations change during treatment for alcohol problems (DiClemente et al. 1995). Treatments have been found to affect self-efficacy differentially; for example, specific skills training has been found to be superior to more generic interventions (Burling et al. 1989; Donovan and Ito 1988). Moreover, differences between individuals' experienced temptation to drink and their abstinence self-efficacy have been identified as an indicator of highly tempted individuals who have a sense of hopelessness about change (DiClemente and Hughes 1990).

Treatment-Specific Effects

Although self-efficacy is theorized to be a common pathway in all human behavior change (Bandura 1986), treatments may differ in their ability to engender self-efficacy. From a treatment-matching perspective, it is assumed that each treatment would influence self-efficacy in a differential manner depending on how the techniques employed by the treatment influenced efficacy evaluations of the client. According to the theory, there are several ways to influence efficacy evaluations that vary in the strength of their influence. Treatments that allow for mastery experiences would be expected to be more powerful in increasing perceived efficacy than would be those treatments that rely solely on vicarious experience or verbal persuasion. From Bandura's social cognitive perspective, long-term behavior change would be the direct result of a treatment's ability to increase the individual's self-efficacy. In Project MATCH, the three chosen treatments were thought to influence self-efficacy differently.

Motivational Enhancement Therapy

One of the explicitly stated goals of Motivational Enhancement Therapy (MET) is to increase clients' self-efficacy by allowing them to draw upon their own resources and make a change plan to reduce or eliminate alcohol consumption (Miller et al. 1992). MET provides feedback to the client about the problem and consequences of alcohol use, places the responsibility for change on the client, and emphasizes the client's ability to change. However, the influence of MET on self-efficacy comes primarily from verbal persuasion and emotional arousal, which are considered potent but not the most powerful sources of efficacy enhancement (Bandura 1986). Therefore, individuals who enter treatment with low efficacy to abstain from drinking may not respond well to the techniques of MET and the fewer sessions in MET. Clients with higher initial self-efficacy would respond better to messages that they can be in charge of the change process and, thus, could be expected to do well in MET. Individuals low in self-efficacy could be expected to do better in a treatment that provides techniques to provide mastery experiences as well as verbal persuasion, such as in Cognitive-Behavioral Coping Skills Therapy (CBT).

Cognitive Behavioral Therapy

CBT has as one of its specific aims the development of skills that would increase the ability

of the individual to cope with high-risk situations by teaching clients to manage their emotions and change their behavior in situations that have triggered drinking in the past (Kadden et al. 1992). This situation specificity and the concentration on the development of skills should contribute directly to an increase in alcohol abstinence self-efficacy. CBT teaches clients coping skills, uses role-plays to test these skills, and prescribes homework that would provide in vivo tests of these skills. It could be assumed that over the 12 weeks of CBT, clients' efficacy would increase, and this increase would translate into greater abstinence at the end of treatment and particularly during the followup periods. Although all individuals in CBT treatment would be expected to need additional help no matter what their level of efficacy, individuals higher in self-efficacy may not need as much assistance and may find the skills training somewhat redundant or more than they need. The most obvious match between self-efficacy and CBT appears to be with the low abstinence self-efficacy clients.

Twelve Step Facilitation

Twelve Step Facilitation (TSF) should have an interesting and potentially inverse relation with self-efficacy. TSF teaches clients that reliance on willpower alone will not achieve sobriety, but that reliance on and relinquishing of control to a higher power is necessary to achieve sobriety (Nowinski et al. 1992). TSF emphasizes that the client is powerless over alcohol and must abstain "one day at a time." For individuals who have a high level of abstinence self-efficacy and want to rely on their own ability to abstain, TSF may be a mismatch (DiClemente 1993). These highly efficacious clients may have more difficulty seeking recourse to a higher power and renouncing their own sense of control. Thus, attrition from TSF may be higher among those clients reporting high self-efficacy. However, since they have higher efficacy to abstain from alcohol compared to other clients at the start of treatment, drinking outcomes may be less affected by this mismatch. Individuals with low self-efficacy, and particularly those with high levels of temptation to drink combined with low levels of efficacy to abstain across situations, may actually find the powerlessness message very compatible with their experiences and benefit most from TSF. The clearest match between TSF and self-efficacy seems to be with individuals having very high temptation levels and very low efficacy levels who are overwhelmed by the drinking habit.

Self-Efficacy Across Treatments

Since efficacy is considered a mediator of all behavior change, baseline and particularly posttreatment levels of efficacy should be predictive of drinking outcomes across all treatments. All treatments, if they produce nondrinking outcomes, could be expected to cause an increase in efficacy. Posttreatment efficacy should be negatively predictive of relapse, positively related to abstinence, and negatively related to levels of drinking posttreatment. Any matching effects would have to emerge in the context of these potential main effects. Since all three treatments could be expected to interact with either high or low levels of abstinence self-efficacy, only the most compelling contrasts were included in the matching hypotheses.

Matching Hypotheses

We predicted differential matching effects for clients who have higher and lower levels of self-efficacy with MATCH therapies. Several contrasts were examined. These contrasts made up the a priori matching hypotheses developed for Project MATCH and are reported elsewhere (Project MATCH Research Group 1997*b*). We articulated the following contrasts on theoretical and empirical grounds.

Hypothesis 1

Clients lower in self-efficacy will have better drinking outcomes in CBT when compared to MET. Conversely, clients higher in self-efficacy will have better drinking outcomes in MET when compared to CBT (figure 1). This second contrast, at the other end of the efficacy spectrum, is expected to have less influence on drinking outcomes, since CBT is specifically

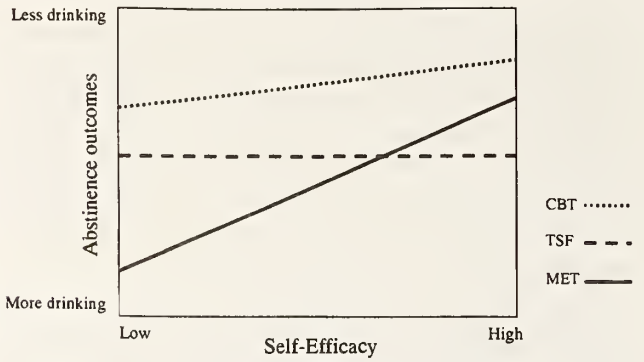

Figure 1. Hypothesized interactions between treatments and self-efficacy on abstinence outcomes

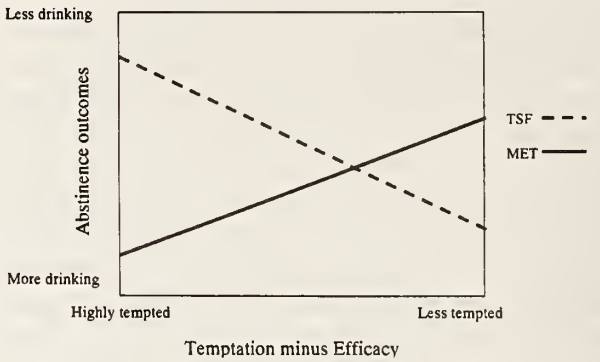

Figure 2. Hypothesized interactions between treatments and temptation minus self-efficacy on abstinence outcomes

designed to remediate low self-efficacy to abstain from alcohol.

Hypothesis 2

Individuals higher in self-efficacy will have better outcomes in terms of abstinence from drinking in MET than TSF. This contrast bets on the mismatching effect between TSF and higher efficacy clients. It could also be hypothesized that individuals lower in self-efficacy could get more support and assistance from TSF and have better outcomes than the low efficacy clients in MET. However, any effect at the lower end of the efficacy dimension may depend on how low is low self-efficacy. Since MET is also designed to increase self-efficacy, this contrast with TSF could be moderated among some of the lower efficacy clients. Therefore, with low self-efficacy clients, TSF may not show significant differences in drinking outcomes when compared with MET low efficacy clients. The best way to identify the low self-efficacy clients and test a contrast at the low end of perceived efficacy would be to use both experienced temptation as well as perceived efficacy as is done in hypothesis 3.

Hypothesis 3

A final contrast associated with self-efficacy compares individuals using a temptation minus efficacy difference score, where larger scores indicate that the client feels more overwhelmed by the alcohol problem. *Highly tempted individuals with larger positive differences will do better with the intense support and the message delivered in the TSF treatment of needing a higher power than with the message of personal responsibility given in MET* (figure 2).

Hypothesized Causal Chain

The self-efficacy hypotheses had a clear and measurable causal chain. Treatments were assumed to influence the clients' efficacy to abstain from drinking and temptation to drink (figure 3). The differential ability of any of the treatments to produce positive changes in self-efficacy over the treatment period would be considered responsible for improved posttreatment outcomes. Self-efficacy was assessed multiple times throughout the trial: at baseline, immediately posttreatment (month 3), and at the 9- and 15-month followup assessments (6 and 12 months posttreatment, respectively). Multiple assessments of perceived efficacy made it possible to examine changes in efficacy during and after treatment in order to determine if different treatments produced differential changes in efficacy and then to assess the effect of changes in efficacy on drinking outcomes. Lastly, we tested whether certain treatments performed better for clients with high or low levels of efficacy and positive or negative differences between temptation and efficacy at the baseline assessment.

In addition to the hypothesized direct effect of matching on the client's efficacy at the end of treatment, treatment matching should also influence other process variables. For example, higher efficacy clients enrolled in TSF should show less compliance, measured in weeks of

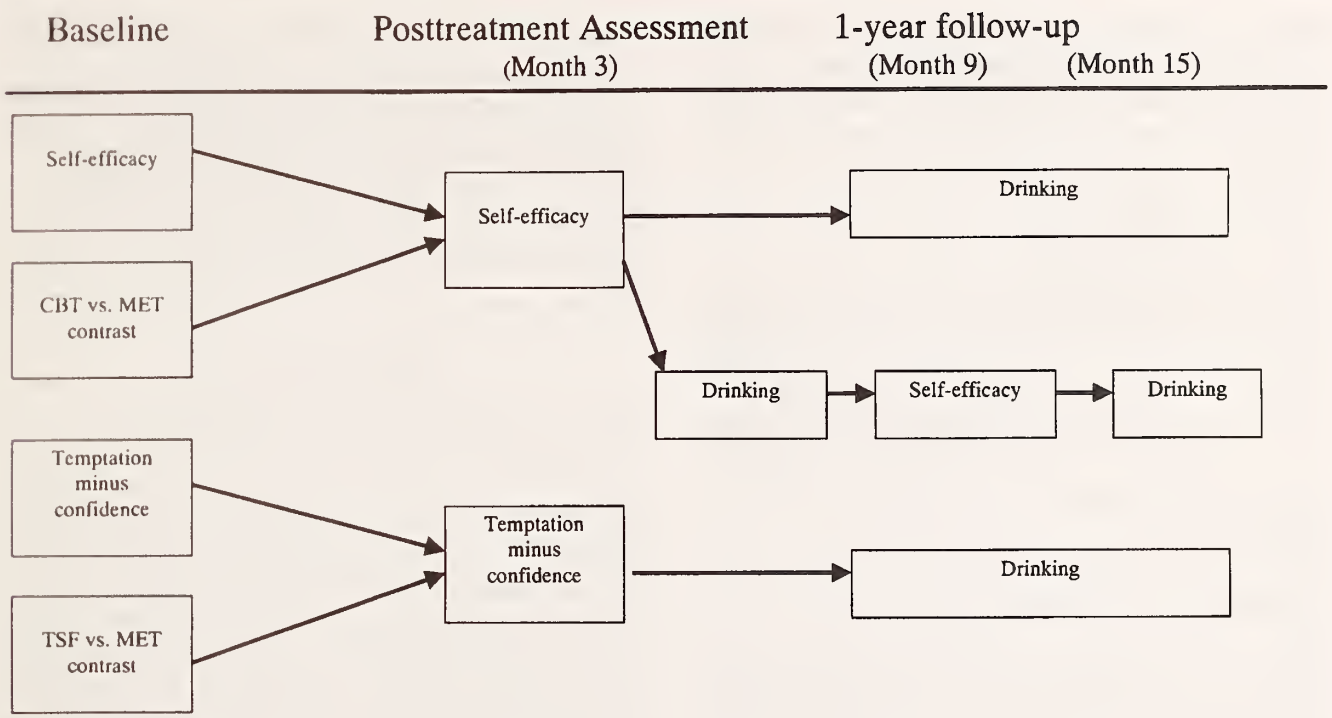

Figure 3. Hypothesized causal chain for self-efficacy contrasts

attendance at therapy, than high efficacy clients enrolled in MET. If CBT helped lower efficacy clients engage in greater use of behavioral processes of change to increase efficacy, then low efficacy CBT-matched clients should demonstrate greater use of behavioral process activity than those in MET. Active coping skills are the focus of the CBT treatment but not the focus of MET, and thus differences in behavioral processes should be seen particularly in the CBT versus MET contrast. Highly tempted individuals with low efficacy should report more AA attendance in TSF than similar clients in MET.

Measures

Alcohol Abstinence Self-Efficacy

For these hypotheses, both temptation to drink and self-efficacy to abstain were assessed using the Alcohol Abstinence Self-Efficacy Scale (AASE; DiClemente et al.1994). This scale consists of 20 items with four 5-item subscales representing types of relapse precipitants: negative affect, social situations and positive emotions, physical and other concerns, and withdrawal and urges. In the efficacy scale, items are rated for "how confident are you that you can abstain from drinking" on a 5-point Likert-type scale (ranging from 1=not at all confident to 5=extremely confident). Item scores are averaged to form the mean level of abstinence self-efficacy across the 20 situations. In a separate form, the same high-risk situations are evaluated and rated for "how tempted are you to drink" with a similar 5-point Likert-type scale. Mean temptation scores are also computed across the 20 situations to evaluate the overall level of temptation to drink. Although subscale scores can be calculated using this scale, only total scores were used in the subsequent analyses.

Alpha reliabilities for the total self-efficacy scale were very good (0.92). They were a little lower for the subscales, but all were above 0.80. Similar alpha coefficients were found for the temptation scale. Initial evaluation of construct validity of the efficacy scale has been supported, with the scale demonstrating substantive correlation with related constructs (DiClemente et al. 1994). The scale has good psychometric properties and produces a respectable range of scores with alcohol-dependent populations

similar to those in Project MATCH. Although temptation and efficacy have been moderately correlated in prior research, they appear to be rather independent (DiClemente et al. 1995; Velicer et al. 1990).

Drinking Outcomes

Our analyses used the main outcome variables from the MATCH trial, percentage of days abstinent (PDA) and drinks per drinking day (DDD). Analyses used transformed variables, and tables presented retransformed data for the PDA and DDD (Project MATCH Research Group 1997*a*; Longabaugh and Wirtz, this volume, pp. 4–17).

Processes of Change

Processes of change represent client coping activities, and measures of processes of change have been used with different addictive behaviors (DiClemente and Prochaska 1998; Prochaska et al. 1988; Snow et al. 1994). In Project MATCH, processes of change were assessed at posttreatment using a 40-item scale that contained subscales for each of 10 processes with 4 items for each process. Clients were asked to indicate on a 5-point Likert-type scale (ranging from 1=never to 5=very frequently) how often they had experienced each of the activities or experiences listed. Twenty of the items comprised experiential (cognitive/affective) processes, and twenty items comprised behavioral processes. Both the 20-item subscales and the 40-item total scale have good psychometric properties, with Chronbach alphas of 0.90 for the experiential and 0.91 for the behavioral subscales (DiClemente et al. 1996). At posttreatment, clients completed the full 40-item version. A brief 8-item version of the processes of change measure was administered at the end of each therapy session as part of a Client Session Report. This measure contained four behavioral process items, two experiential process items, and two helping relationship items.

Treatment Compliance

Treatment compliance was measured as the number of weeks of treatment attendance. Although MET consisted of only four sessions, the sessions extended over the 12 weeks. Thus, the weeks of treatment provided an equivalent measure across treatments (Mattson et al. 1998).

Results

Alcohol Abstinence Self-Efficacy

Clients in each arm of the trial were divided into three groups according to their baseline AASE scores in order to examine the distribution of efficacy scores between arms and among treatment conditions. The lowest third in each arm was the low efficacy group, the middle group in each arm was the medium efficacy group, and the highest third in each arm was the high efficacy group. The three groups in each arm were not exactly equivalent in number since cut points were never made within the same value.

Table 1 reports the means and standard deviations of the AASE scores at the baseline assessment for the trichotomized groups and the overall means for both the outpatient and the aftercare participants in Project MATCH. There were significant differences between the outpatient and aftercare groups, with the aftercare clients demonstrating higher overall levels of

Table 1. Means and standard deviations for baseline abstinence self-efficacy groups (trichotomized)

	Baseline abstinence self-efficacy			
	Low	Medium	High	Overall
Outpatient arm	*n*=322	*n*=295	*n*=307	*n*=924
Mean (*SD*)	2.13 (.38)	2.91 (.19)	3.84 (.49)	2.94 (.80)
Range	100–2.59	2.60–3.20	3.21–5.00	1.00–5.00
Aftercare arm	*n*=244	*n*=248	*n*=246	*n*=738
Mean (*SD*)	2.02 (.56)	3.24 (.27)	4.31 (.41)	3.20 (1.03)
Range	1.00–2.78	2.80–3.70	3.75–5.00	1.00–5.00

NOTE: Efficacy items were scored from 1=not at all to 5=extremely.

abstinence self-efficacy than the outpatients at both baseline and 3-month (immediately posttreatment) assessments. Since aftercare clients completed the baseline efficacy measure during the course of an inpatient or intensive day treatment episode, these higher evaluations are not surprising. Abstinence was achieved and supported by the aftercare environment. Thus, despite the fact that aftercare clients had significantly more baseline dependence symptoms and more consequences and problems related to drinking prior to the intensive treatment, they appeared more confident in their ability to abstain from drinking than their outpatient counterparts did at the initial assessment. This significant difference persisted but got smaller at 3 months and then disappeared at the final followup assessment. These differences were also reflected in the fact that the aftercare clients had greater levels of abstinence at the beginning of the MATCH treatments as well as throughout the treatment period (Project MATCH Research Group 1997*a*, 1998*a*). These differences support the separate analysis of this variable by arm.

At the baseline assessment, client-perceived self-efficacy demonstrated low correlations with most of the other primary and secondary matching variables in both arms of the trial. Client efficacy was not correlated ($r<0.10$) with motivational readiness to change as measured by the University of Rhode Island Change Assessment scale (Carbonari et al. 1994) or the Stages of Change Readiness and Treatment Eagerness Scale, to Alcoholics Anonymous (AA) involvement in the prior 3 months, social support for drinking, or psychopathology. Efficacy was most related to Alcohol Involvement, as measured by the Alcoholics Anonymous Involvement Scale (Tonigan et al. 1996), in the outpatient ($r=-0.14$) and aftercare ($r=-0.23$) arms of the trial. Efficacy evaluations appeared rather independent of most other client characteristics.

As expected, efficacy was highly related to the temptation minus efficacy measure ($r=-0.82$ aftercare and -0.88 outpatient). Temptation minus efficacy was also unrelated to motivational readiness to change and AA involvement. However, this temptation minus confidence measure was more highly correlated with alcohol involvement ($r=0.37$ outpatient and 0.31 aftercare) and with meaning seeking ($r=0.27$ outpatient and 0.31 aftercare), social functioning ($r=-0.25$ outpatient and aftercare), and alcohol dependence ($r=0.29$ outpatient and 0.24 aftercare). The high temptation measure, compared to the efficacy measure, was related more to physiological and psychological dependence and disrupted social functioning, as would be expected.

Matching Hypotheses

Outpatient Arm

For the hypotheses that used baseline self-efficacy as the matching variable, there was little evidence for any matching effect or matching effect by time interactions with hypothesized treatment contrasts in the outpatient arm of the trial, using Bonferroni-adjusted levels of significance (table 2). This was true for drinking outcomes both during treatment and following the treatment period. Only one contrast (CBT versus MET) demonstrated an interaction effect on DDD in the posttreatment period that reached an unadjusted level of significance, $p<.05$. This finding indicated that low self-efficacy clients had fewer drinks per drinking day in MET than comparable clients in CBT, contrary to the hypothesized interaction.

Table 2. Hierarchical linear modeling results for within treatment and posttreatment drinking in the outpatient arm for the abstinence self-efficacy matching hypotheses

MV × Tx	Overall effect (*F*)	CBT–MET (*t*)	CBT–TSF (*t*)	MET–TSF (*t*)
Within treatment				
PDA	1.13	1.50	0.86	-0.68
DDD	0.81	-1.22	-0.33	0.92
Posttreatment				
PDA	0.78	0.93	1.19	0.25
DDD	2.12	-2.00*	-0.63	1.43

NOTE: MV=matching variable, Self-Efficacy; Tx=treatment. *F* tests were used for the overall effect, and *t*-tests were used for pairwise treatment contrasts.
*$p< .05$

There were no indications in the outpatient arm of any matching effect for the hypothesis about the highly tempted clients (temptation minus confidence) doing better in TSF as opposed to MET either during treatment or at posttreatment assessments (table 3).

Table 3. Hierarchical linear modeling results for within treatment and posttreatment drinking in the outpatient arm for the temptation to drink minus abstinence self-efficacy matching hypotheses

MV × Tx	Overall effect (*F*)	CBT–MET (*t*)	CBT–TSF (*t*)	MET–TSF (*t*)
Within treatment				
PDA	1.04	-1.40	-1.03	0.42
DDD	0.62	1.09	0.39	-0.75
Posttreatment				
PDA	0.30	-0.50	-0.76	-0.24
DDD	0.83	1.12	0.04	-1.12

NOTE: MV=matching variable, Temptation to Drink minus Self-Efficacy; Tx=treatment. *F* tests were used for the overall effect, and *t*-tests were used for pairwise treatment contrasts. All effects were nonsignificant.

Aftercare Arm

Several matching effects appeared during the within-treatment period but disappeared after treatment (table 4). No significant matching effects were found for any contrast during the posttreatment period. For drinking during treatment, however, the overall self-efficacy by treatment interaction was significant for the PDA outcome ($p<.008$). The specific CBT versus MET contrast during treatment demonstrated Bonferroni-corrected significant effects for the PDA outcome and unadjusted significant effects on the DDD outcome. As hypothesized, the means across the 3-month treatment period demonstrated that the low efficacy CBT clients had significantly more days abstinent during the treatment period than low efficacy MET clients (figure 4). Again during treatment, clients in MET with higher levels of self-efficacy were doing better in terms of DDD and PDA than similar CBT clients, although these differences were not statistically significant (Project MATCH Research Group 1997*b*). In addition, there was an unadjusted significant effect for the MET versus TSF contrast on the PDA outcome. Again as hypothesized, higher self-efficacy clients in MET had slightly more days abstinent than TSF clients did during the treatment period.

Table 4. Hierarchical linear modeling results for within treatment and posttreatment drinking in the aftercare arm for the abstinence self-efficacy matching hypotheses

MV × Tx	Overall effect (*F*)	CBT–MET (*t*)	CBT–TSF (*t*)	MET–TSF (*t*)
Within treatment				
PDA	5.49**	-3.26**	-0.94	2.30*
DDD	2.67	2.23*	0.47	-1.73
Posttreatment				
PDA	1.06	1.00	-0.51	-1.44
DDD	0.87	-1.30	-0.35	0.93

NOTE: MV=matching variable, Self-Efficacy; Tx=treatment. *F* tests were used for the overall effect, and *t*-tests were used for pairwise treatment contrasts. *$p<.05$ **$p<.008$ (Bonferroni-corrected level of significance)

These results offer strong support for the first specific hypothesized contrast (CBT versus MET) and some support for the second specific hypothesized contrast between treatments (MET versus TSF) and client baseline levels of self-efficacy among aftercare participants. However, even the CBT versus MET hypothesis was not supported completely since the hypothesized effects were not significant after correction for both of the drinking outcomes. Moreover, these significant effects were limited to drinking outcomes during aftercare treatment and did not appear at all in the posttreatment period, where matching effects are traditionally sought. Nevertheless, for clients entering aftercare treatment, the level of their efficacy assessed during the more intensive prior therapy did have interesting interactions with the MATCH treatments.

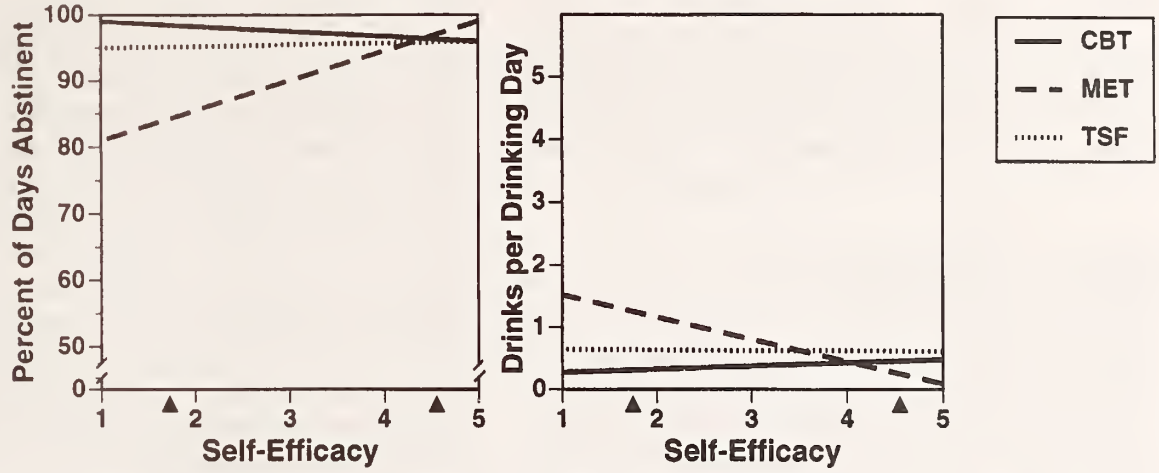

Figure 4. Within-treatment plots of percentage of days abstinent and drinks per drinking day showing the interaction between the three treatments and self-efficacy in the aftercare arm. The vertical axes represent predicted outcome scores and the horizontal axes represent baseline self-efficacy, with higher scores indicating higher self-efficacy. The triangles on the horizontal axes indicate the 10th and 90th percentiles for self-efficacy in this study arm.

There were no significant effects for the one hypothesized contrast between TSF and MET using the temptation minus confidence variable in the aftercare arm. One nonhypothesized interaction of treatment and baseline temptation minus efficacy emerged that reached an unadjusted level of significance. Similar to the results reported above, these effects were in the CBT versus MET contrast, indicating that highly tempted clients (i.e., those with high temptation to drink and low self-efficacy to abstain) did somewhat better in CBT than in MET. Once again, these effects occurred only within treatment and not during the posttreatment period (table 5).

In summary, there was support for the self-efficacy matching hypotheses only in the aftercare arm and only for abstinence from drinking within the period during which aftercare treatment was administered. However, these within-treatment aftercare effects were interesting because clients had their efficacy assessed during an inpatient or intensive day treatment episode and most were abstinent at the beginning of the aftercare treatment. Thus, efficacy interactions with treatment during the aftercare treatment period represented the initial testing of the clients' abstinence self-efficacy for immediate posthospitalization drinking outcomes as well as the success of various treatments in sustaining the gains made during the inpatient treatment. MET seemed to do well with the high self-efficacy aftercare clients, and there was evidence that CBT did better than MET with the less efficacious clients on drinking outcomes immediately after release from intensive

Table 5. Hierarchical linear modeling results for within treatment and posttreatment drinking in the aftercare arm for the temptation to drink minus abstinence self-efficacy matching hypotheses

MV × Tx	Overall effect (*F*)	CBT–MET (*t*)	CBT–TSF (*t*)	MET–TSF (*t*)
Within treatment				
PDA	2.91	2.41*	1.29	-1.16
DDD	1.24	-1.54	-1.02	0.55
Posttreatment				
PDA	1.08	-1.35	-0.11	1.23
DDD	1.71	1.80	0.47	-1.34

NOTE: MV=matching variable, Temptation to Drink minus Self-Efficacy; Tx=treatment. *F* tests were used for the overall effect, and *t*-tests were used for pairwise treatment contrasts. *$p<.05$

treatment. Since these matching effects emerged and then disappeared in the aftercare arm, we examined the assumed causal linkages for within treatment and posttreatment interactions in order to evaluate how efficacy and other relevant variables were interrelated.

Efficacy, Temptation, and Drinking Outcomes

Outpatient Arm

For both the PDA and DDD outcomes over the 4- to 15-month followup periods, client abstinence self-efficacy predicted frequency and intensity of drinking in the outpatient arm of the trial (Project MATCH Research Group 1997*b*). Initial levels of abstinence self-efficacy played some role in drinking outcomes both during treatment and throughout the 1-year followup. Moreover, baseline efficacy was predictive of drinking intensity even at a 3-year followup (Project MATCH Research Group 1998*b*). Along with motivational readiness to change, abstinence self-efficacy was considered one of the most important overall predictors of drinking for outpatients (DiClemente et al., this volume; Project MATCH Research Group 1998*b*). As is illustrated in table 6, baseline abstinence self-efficacy had a small but consistent relationship with reported PDA at the end of treatment and at the 9- and 15-month drinking assessments. There was a smaller and less consistent relationship between efficacy and DDD during the posttreatment period.

Baseline self-efficacy was also related to baseline drinking in the 3 months prior to entry into treatment. As Bandura has indicated, efficacy appears to reflect past behavior as well as predict future behavior. This reciprocal relationship was also supported by the pattern of correlation between efficacy at one time point

Table 6. Correlations between abstinence self-efficacy and temptation to drink at baseline and 3, 9, and 15 months and PDA and DDD at baseline, week 12 of treatment, and 9 and 15 months: Outpatient arm

	PDA				DDD			
	BL	Wk 12	9 mo	15 mo	BL	wk 12	9 mo	15 mo
ASE								
Baseline	.07*	.14***	.14***	.10**	-.07*	-.03***	-.09**	-.07
3 mo		.35***	.29***	.25***		-.33***	-.26***	-.21***
9 mo			.41***	.37***			-.39***	-.33***
15 mo				.44***				-.39***
Temp								
Baseline	-.19***	-.20***	-.15***	-.11**	.14***	.19***	.09**	.12***
3 mo		-.38***	-.33***	-.31***		.40***	.31***	.31***
9 mo			-.55***	-.45***			.52***	.40***
15 mo				-.54***				.53***
PDA								
Baseline					.01			
Wk 12						-.76***		
9 mo							-.65***	
15 mo								-.64***

NOTE: PDA=percentage of days abstinent; DDD=drinks per drinking day. PDA and DDD are the average of PDA and DDD reported by clients during the prior 3 months. * $p<.05$, ** $p<.01$, *** $p<.001$

and concurrent and future drinking. The greater consistency in the pattern of correlation between efficacy and both drinking outcomes (PDA and DDD) posttreatment as compared to during treatment is related to the fact that PDA and DDD become more highly correlated after the initial evaluation, when abstinence is greater.

Client reports of temptation at baseline demonstrated a larger and more consistent relationship with drinking outcomes than did self-efficacy, both during treatment and throughout the posttreatment period. Posttreatment temptation appeared to have a stronger relationship with relapse than efficacy. There was a correlation of over 0.5 between temptation to drink reported at the 9-month assessment and client drinking in the 3 months prior to the assessment, indicating the influence of relapse on level of temptation. There was a correlation of 0.4 between temptation to drink reported at the 9-month assessment and drinking during the next 3 months that was reported at the end of the followup year (month 15), supporting the relationship between temptation and future drinking frequency and quantity.

Aftercare Arm

In the aftercare arm, there were no significant effects for initial baseline level of abstinence self-efficacy on either within-treatment or posttreatment drinking outcomes (Project MATCH Research Group 1997*b*). Posttreatment abstinence self-efficacy, however, presented a different picture (table 7). Efficacy assessed immediately posttreatment (AASE month 3) and efficacy to abstain assessed at the 9- and 15-month followup periods were highly correlated with drinking outcomes. In these posttreatment assessments, the relationships between efficacy and drinking were similar to those found among outpatients. Once again,

Table 7. Correlations between abstinence self-efficacy and temptation to drink at baseline and 3, 9, and 15 months and PDA and DDD at baseline, week 12 of treatment, and 9 and 15 months: Aftercare arm

	PDA				DDD			
	BL	Wk 12	9 mo	15 mo	BL	wk 12	9 mo	15 mo
ASE								
Baseline	.01	.02	.06	.01	-.10**	-.02	-.12**	-.07
3 mo		.32***	.32***	.25***		-.35***	-.28***	-.30***
9 mo			.41***	.32***			-.40***	-.34***
15 mo				.48***				-.47***
Temp								
Baseline	-.05	-.06	-.14***	-.11**	.21***	.07	.18***	.14***
3 mo		-.33***	-.28***	-.26***		.36***	.28***	.29***
9 mo			-.46***	-.37***			.45***	.38***
15 mo				-.55***				.53***
PDA								
Baseline					.14			
Wk 12						-.85***		
9 mo							-.76***	
15 mo								-.73***

NOTE: PDA=percentage of days abstinent; DDD=drinks per drinking day. PDA and DDD are the average of PDA and DDD reported by clients during the prior 3 months. $p<.05$, **$p<.01$, ***$p<.001$

this supports the view that efficacy and temptation assessed during the intensive treatment were problematic and perhaps not as accurate as assessments made when clients were freer to drink.

Baseline levels of temptation demonstrated robust and significant relationships with posttreatment drinking. Temptation appeared to be a better measure of relapse potential for these aftercare clients than efficacy. Temptation may be a better way to assess craving and urges to drink that are more critical when they are present after the client achieves abstinence. Temptation evaluations are influenced by and, in turn, influence the client's ability to be abstinent, as does self-efficacy.

In Summary

In the outpatient arm, baseline self-efficacy predicted both the intensity and quantity of drinking throughout the posttreatment period. This main effect on drinking outcomes of client efficacy to abstain from drinking is consistent with the theoretical assumption that efficacy is influenced by and also influences drinking outcomes. Baseline self-efficacy predicted drinking outcomes for the outpatient clients but not for the aftercare clients, who were assessed during a more intensive therapy. However, efficacy assessed during the posttreatment and followup assessments was significantly and highly related to drinking both for outpatient and aftercare clients. Temptation to drink, which represents clients' acknowledgment of how highly tempted they are across a range of situations, was also a potent predictor of both intensity and quantity of drinking in both arms of the trial.

Changes During Treatment

One of the central hypothesized causal mechanisms for the interaction of efficacy and treatment was that matched clients would demonstrate higher self-efficacy posttreatment compared to their pretreatment baseline levels. In both arms of the trial, there was a significant effect for time. Efficacy increased from baseline to the assessment immediately posttreatment and then leveled off at the 9- and 15-month assessments (table 8). It should be noted that differences between levels of efficacy immediately posttreatment and at the end of the 1-year followup represent a decline of only 5 percent or less, indicating that, for the most part, overall efficacy stabilized posttreatment.

Table 8. Means and standard deviations for alcohol abstinence self-efficacy over time by treatment assignment

Treatment assignment	Baseline *M* (*SD*)	3 mo *M* (*SD*)	9 mo *M* (*SD*)	15 mo *M* (*SD*)
Outpatient arm				
CBT	2.92 (0.8)	3.47 (0.9)	3.36 (1.1)	3.41 (1.1)
MET	2.98 (0.8)	3.38 (0.9)	3.40 (1.1)	3.45 (1.1)
TSF	2.93 (0.8)	3.47 (1.0)	3.47 (1.1)	3.44 (1.1)
Aftercare arm				
CBT	3.25 (1.0)	3.73 (1.0)	3.54 (1.2)	3.52 (1.2)
MET	3.22 (1.0)	3.48 (1.0)	3.41 (1.1)	3.46 (1.1)
TSF	3.10 (1.0)	3.56 (1.1)	3.47 (1.2)	3.44 (1.2)

NOTE: Efficacy items were scored from 1=not at all to 5=extremely. No significant differences were found for treatment assignment except for aftercare arm at 3 months where MET < CBT ($p<.05$).

We examined the changes in self-efficacy from baseline to posttreatment by efficacy group and by treatment using a series of ANOVAs with efficacy changes and drinking outcomes as the dependent variables. There was a significant main effect for initial amount of perceived efficacy on changes in efficacy. The low self-efficacy group increased most during treatment, followed by the medium and then the high groups. High self-efficacy participants showed only slight increases, perhaps due to a ceiling effect.

There were no differences in before/after treatment changes in self-efficacy among the three MATCH treatments in the outpatient arm, although the MET clients showed the least average change (table 9). There was, however, a significant interaction between treatment and these changes in efficacy, $F(4, 682)=2.62$, $p<.05$.

Table 9. Comparison of group means and standard deviations for change in abstinence self-efficacy (posttreatment – baseline) by treatment assignment in outpatient and aftercare arms

Change in Self-Efficacy	CBT	MET	TSF	Tukey's B comparisons
Outpatient	.63 (.98)	.41 (1.2)	.54 (1.1)	ns
Aftercare*	.59 (1.2)	.30 (1.2)	.43 (1.2)	MET<CBT

NOTE: One-way ANOVAs were used. Post hoc comparisons were made using the Tukey's B procedure. Pairwise comparisons that were significant are designated by a < symbol. *p<.05

Low efficacy MET clients had a greater increase in efficacy (M=1.27) than did their counterparts in the other two treatments (CBT=1.04; TSF=1.07), contrary to the hypothesized mechanism. The opposite was true in the medium and high self-efficacy groups, in which MET clients increased less in efficacy than did those in CBT. The TSF clients at the upper levels of efficacy had changes that fell between the MET–CBT split.

In the aftercare arm, there was a significant overall difference between treatments in changes in before/after efficacy. MET clients demonstrated less change than the CBT clients did. In addition, at the 3-month posttreatment assessment, there was a significant difference between MET and CBT clients, with the CBT clients having significantly higher levels of efficacy. However, there were no significant interactions between levels of efficacy and treatments for changes in self-efficacy. Although nonsignificant, examination of the changes within the levels of efficacy revealed that low self-efficacy CBT clients had the most increase in self-efficacy, as hypothesized (before/after average difference=1.46 versus MET average difference=1.23). Differences between MET and TSF for clients at the higher levels of efficacy were not in the hypothesized direction (TSF before/after average difference=-0.22 versus -0.42 for MET). Again, these interactions were not significant and, as noted above, clients with initial high levels showed little change or a slight decline.

In summary, there was an overall increase in efficacy from baseline to posttreatment for all treatments and for both arms of the trial, indicating changes in efficacy during the treatment period. However, only a few changes in efficacy were related to differences among treatments or to the interaction of treatment and levels of baseline efficacy.

In the outpatient arm, there was a significant interaction between changes in efficacy and treatment condition, with MET doing better than CBT and TSF with low self-efficacy clients and not as well with the high efficacy clients. Contrary to our best guess, there was evidence that MET interacted with low levels of efficacy with outpatients to produce slightly more change in efficacy than the other treatments. There was also a lack of hypothesized matching effects in this arm, so that there was consistency between effects and mechanisms. On the other hand, among these outpatients, their baseline perceived efficacy was a significant predictor of drinking posttreatment across all three treatments.

In the aftercare arm, where a matching effect for the CBT and MET contrast was found during the treatment period, there were also treatment differences in the shifts in efficacy from baseline to posttreatment. Clients in CBT demonstrated greater positive changes in efficacy compared to clients in MET, but there was no significant interaction between treatments and level of efficacy on before/after changes in efficacy. Thus, CBT did better in fostering changes in self-efficacy across all levels of efficacy.

Overall, CBT produced greater changes in self-efficacy than the MET treatment, consistent with its focus on skills and efficacy. This finding supported the matching effects on drinking within treatment. However, CBT did not produce significant shifts in self-efficacy differentially by level of baseline efficacy as would be expected from the matching effect, thus the specificity of this mechanism for lower self-efficacy clients has not been identified. In the aftercare arm, MET clients did not maintain efficacy as well as clients in the other treatments, irrespective of initial level of efficacy. Finally, TSF did not interact with changes in efficacy as was hypothesized. Changes in efficacy for TSF

clients appeared to lie between the CBT and MET clients across levels of baseline efficacy. There was no support for a conflict between the messages of TSF and clients with higher initial levels of abstinence self-efficacy.

Efficacy and Processes of Change

A set of experiential and behavioral processes of change was assessed after each treatment session and at the end of treatment as described above. Client-reported process activity was examined for its relationship with baseline efficacy and treatment condition. Although not part of the putative causal chain, outpatient clients in CBT reported significantly less experiential process activity at Session 2 than did those in TSF. However, this difference was not evident at the end-of-treatment assessment period. Also, in the outpatient arm, the low baseline self-efficacy group reported significantly more cognitive/experiential process activity at the end of treatment than did those in the high self-efficacy group ($p < .05$). Neither at Session 2 nor at posttreatment were there any significant interactions between efficacy and treatment condition on process activity, consistent with the lack of matching found in this arm.

In the aftercare arm, at the Session 2 assessment, clients in MET reported less cognitive/experiential process activity compared to those in TSF. Again, there were no differences at the posttreatment assessment and no significant interactions between efficacy and treatment on process activity. In the aftercare arm, clients low in self-efficacy reported less frequent use of helping relationships than those in the high self-efficacy group at Session 2, but there were no differences between efficacy groups at the posttreatment assessment. Efficacy levels did not interact with behavioral process activity by treatment in order to produce any matching effect. The within-treatment matching effect found between CBT and MET and between TSF and MET did not have concomitant differential behavioral process activity. Thus, there was no support for a causal link between treatment and efficacy evaluations through the processes of change assessed during or after treatment.

Treatment Compliance and Efficacy

Compliance with treatment was another potential process link between efficacy and treatment. There was a small and clinically insignificant main effect of treatment on number of weeks in treatment. CBT had a slightly higher average number of weeks compared to TSF (8.8 versus 8.1) across both arms of the trial (Mattson et al. 1998). There were no differences in compliance due to baseline efficacy levels. Finally, there was no treatment by efficacy interaction on weeks in treatment in either arm of the trial. There was no evidence for an intermediary role for compliance in any of the aftercare within-treatment matching effects.

Efficacy and Attendance at AA

One final interesting relationship that could be involved in the interaction of efficacy with treatment involves the clients' attendance at AA and its impact on efficacy evaluations. We examined this question with a simple correlation matrix of AA attendance reported for the 3 months prior to an assessment point with the reported efficacy at that assessment. In the outpatient arm of the trial, the relationships between efficacy and AA attendance were small, with the largest correlation between AA attendance in the months 12 through 15 and abstinence self-efficacy assessed at month 15 ($r = 0.11$). Efficacy at the posttreatment assessment was significantly but minimally correlated with amount of AA attendance during treatment ($r = 0.10$). Most relationships were nonsignificant, even with this large number of subjects.

In the aftercare arm, in which there was substantially more AA attendance compared to the outpatient arm, a greater number of correlations were significant. The absolute level of the correlations was moderate at best, with the highest correlation occurring between AA attendance from months 6 through 9 with abstinence self-efficacy assessed at month 9 ($r = 0.18$). Relationships between perceived efficacy assessed at one time point and AA attendance in the months prior to that assessment were about the same as the correlations of current efficacy with future AA attendance, indicating a small,

interactive relationship between the two constructs. However, it does not appear that the overall relationship between AA attendance and efficacy would confound our causal chain analysis since posttreatment efficacy was only minimally related to AA attendance.

To further clarify these relationships, we examined the correlations between AA attendance and efficacy within treatment groups since mean levels of attendance differed by treatment, with TSF showing the greatest attendance in both the outpatient and aftercare arms of the trial. Among outpatients, the correlations between AA and efficacy were minimal and not significant for clients in CBT and MET. Significant modest correlations, ranging from 0.16 to 0.21, were found for the TSF clients. Temptation to drink demonstrated a more modest association that was negative in sign. More temptation at one time point was associated with less AA attendance at the next, and more AA attendance in the prior months was associated with less temptation at the next assessment.

Among aftercare clients, similar low levels of association between AA attendance and efficacy were found for CBT. However, for MET clients, the relationships were a bit stronger, ranging from r=0.12 to 0.20. For TSF clients, the correlations between AA and efficacy ranged from r= 0.15 to 0.23. Temptation to drink measures correlated less strongly and negatively as in the outpatient sample for all three treatments but were stronger (r=0.18 to 0.23) for both MET and TSF clients. Overall, the correlations between efficacy and AA attendance were stronger for TSF clients than for the other treatments. However, the actual correlations were small and supported a reciprocal interactive effect of efficacy on AA attendance and AA attendance on efficacy. The similar negative direction of the association between temptation and AA attendance across all three treatments indicated that there was no positive interaction of TSF with temptation to drink as was hypothesized.

Summary of Causal Chain Analyses

Although there was some support for a matching effect in the aftercare arm of the trial on drinking during treatment, there was little evidence to suggest that levels of self-efficacy related in any consistent manner to the proposed causal mechanisms. Efficacy levels demonstrated a few significant interactions with specific treatments on changes in self-efficacy during the treatment period. For example, CBT had significantly greater positive changes in self-efficacy during treatment compared to MET in aftercare, where there emerged matching effects during treatment.

In addition, as would be expected, the level of baseline efficacy was related to changes in self-efficacy during treatment, with low efficacy clients demonstrating the greatest change. However, there were no significant interactions between treatments and levels of efficacy on before/after changes in efficacy. In the aftercare arm, self-efficacy interacted with treatment immediately after discharge from the intensive treatment to affect drinking during aftercare treatment but did not do so during the posttreatment period, where matching effects disappeared. However, causal mechanisms were developed largely to predict posttreatment matching rather than during treatment matching. Specific proposed causal mechanisms were not supported as causal links in the within-treatment matching effects.

In the outpatient arm, there was little support for causal mechanisms as well. This would be expected, since there was no support for the hypothesized matching effects on drinking outcomes either during treatment or in the posttreatment period. There was one difference between treatments by self-efficacy groups on drinking outcomes. Baseline self-efficacy in the outpatient arm was a predictor of drinking outcomes, with high levels of efficacy predicting greater abstinence posttreatment. Level of efficacy also predicted changes in efficacy during treatment. However, there was no overall effect of treatment on changes in self-efficacy.

Although there was no matching, there was an interaction between efficacy and treatment on before/after changes in efficacy. MET showed the largest positive change in efficacy for low efficacy clients and the smallest change for the high efficacy clients compared to clients in both the other treatments. This interaction was opposite to that hypothesized but was consistent

with the finding of no support for the matching hypotheses.

Discussion

The self-efficacy matching hypothesis that predicted a superior effectiveness of CBT for low self-efficacy participants and a problematic interaction of TSF with high self-efficacy clients received little support. Only within-treatment drinking in the aftercare arm demonstrated some effects for matching, but these were weak, and only one was in the hypothesized direction. However, these findings indicated that clients emerging from intensive treatments with higher levels of temptation and lower levels of efficacy would do better in the short term in the more extensive CBT treatment rather than in MET.

The causal chain analyses reported above yielded interesting information. There were clear differences in level and predictive ability of efficacy evaluations given by outpatients and those reported by clients assessed during intensive treatment, clearly supporting an effect of assessment setting (arm of trial) on efficacy levels. Aftercare clients' assessments of self-efficacy prior to entry into aftercare were not predictive of outcomes and showed few interactions with process variables. We concluded that these efficacy evaluations taken during intensive treatment were less valid or, possibly, less accurate than those gathered from outpatients who had opportunity and freedom to drink when evaluating their confidence to abstain from alcohol.

However, aftercare clients' efficacy evaluations showed some interesting interactions with treatments in terms of drinking outcomes during treatment. There were indications that CBT has some ability to increase efficacy during aftercare treatment better than MET does. CBT also produced more abstinence for low self-efficacy clients compared to MET, as was hypothesized. On the other hand, MET produced a bit more abstinence than CBT and TSF for high self-efficacy clients in the first couple of months of treatment and during the month immediately posttreatment for aftercare clients. No matching effect extended into the entire posttreatment period. Thus, there were matching interactions but no main effect for efficacy in the aftercare arm.

In the outpatient arm, there were fewer interactions but a clear ability of self-efficacy to predict drinking intensity and frequency. Baseline efficacy was a better predictor of future drinking with clients who were struggling to establish and maintain abstinence in this outpatient setting, where it can be assumed that the cues for drinking were more readily available than for those coming into an aftercare setting. There was some evidence that MET supported self-efficacy for the less efficacious but no evidence of a mismatching between high self-efficacy clients and the TSF treatment. Both of these findings are contrary to the hypothesized causal chain.

In terms of the three treatments, our assumed mechanisms of action were not supported to any great extent. Although supporters of CBT and MET could claim some differential effect of these treatments on efficacy, these differences were neither dramatic nor consistent enough to support an overall interpretation of the effect. The TSF treatment did not negatively interact with the high self-efficacy clients. Either the high efficacy clients found that the powerlessness message was not about abstinence self-efficacy or these clients ignored any personal powerlessness connotations and benefited from the support and modeling of the TSF and associated AA intervention. Whatever the mechanism, there were not many differences by level of efficacy for TSF clients in either arm of the trial. Relationships between AA attendance and efficacy were modest and positive as well as interactive in nature.

When studying efficacy, securing a sample with a broad enough range of efficacy scores to allow for an examination of the effects of efficacy would be important. In the Project MATCH samples, there was a broad range of efficacy scores, with the high efficacy clients very different from the low efficacy clients, who had mean scores hovering at 2 on a 1 to 5 scale. Additionally, efficacy levels had good variability within both the outpatient and aftercare arms. Low efficacy clients did worse in terms of drinking in the outpatient arm. Thus, there was enough diversity and breadth of efficacy scores

to produce effects. Moreover, efficacy levels changed over time from before to after treatment differentially by level of initial perceived efficacy. These changes either supported an effect for the treatment or, at the very least, demonstrated that individuals taking action and achieving significant numbers of abstinent days in the posttreatment period had commensurate changes in their levels of abstinence self-efficacy.

More interesting insights follow from these analyses. Although efficacy evaluations were sensitive to setting (arm of trial) and clearly tracked the process of achieving abstinence from drinking, it is noteworthy that temptation to drink was as good, if not a little better, predictor of drinking outcomes in both the outpatient and aftercare arms. Change process activity, which was highly related to baseline motivation (DiClemente et al., this volume), was mostly unrelated to level of self-efficacy. In studies of smoking abstinence self-efficacy, the relationship between efficacy and processes of change varied according to the client's stage of change (DiClemente et al. 1985). If clients had been differentiated according to stage of change in these analyses, then perhaps a more meaningful relationship between efficacy and processes of change might have emerged (DiClemente et al. 1992). Efficacy evaluations were not related to baseline motivational readiness to change and thus appeared to be independent of motivation, as has been discussed in a prior review of efficacy (DiClemente et al. 1995).

Although the three MATCH treatments were hypothesized to have differential impacts on clients with various levels of baseline abstinence self-efficacy, there was little evidence that the three treatments influenced efficacy in unique ways or had any unique influence on clients depending on their levels of efficacy. If future research were to seek self-efficacy matching effects, very different treatment parameters or more complex and multidimensional matching hypotheses should be considered. Several examples come to mind. A future study could match prospectively on efficacy levels to some type of self-help versus formal treatment. Another strategy would be to match different relapse prevention strategies to groups who have achieved abstinence but are high or low on efficacy. Finally, one could segment by stage of change and then attempt to match high and low efficacy participants with stage-specific interventions.

Matching treatments to efficacy levels is certainly more complicated than had been proposed in the literature. The analyses in this chapter have provided one of the most indepth views of alcohol abstinence self-efficacy and its interaction with the process of treatment in a controlled trial. There is still much to learn about how treatments influence efficacy and how efficacy influences treatment outcomes. The reciprocity of the influence of efficacy on behavior and of behavior on attributions makes this a challenging enterprise. Our hope is that the analyses provided here contribute to this body of knowledge and assist in understanding this interesting and important self-evaluation called alcohol abstinence self-efficacy.

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Part VI: Interpersonal Functioning and Support

Network Support for Drinking

Prior Alcoholics Anonymous Involvement and Treatment Outcome

Social Functioning

Network Support for Drinking

Richard Longabaugh, Ed.D., Philip W. Wirtz, Ph.D., Allen Zweben, D.S.W., and Robert Stout, Ph.D.

ABSTRACT

Network support for drinking is prognostic of poorer drinking outcomes. To examine whether treatment can negate this effect, two a priori matching hypotheses involving network support for drinking were tested: Cognitive-Behavioral Coping Skills Therapy (CBT) will be incrementally more effective than Motivational Enhancement Therapy (MET) for clients who have pretreatment networks highly supportive of drinking, and Twelve Step Facilitation (TSF) will be incrementally more effective than MET for clients with networks highly supportive of drinking. Results from the first 15 months indicated no support for a sustained matching effect for either matching hypothesis. However, for outpatient clients followed for 3 years from the end of treatment, the hypothesized support by TSF versus MET matching effect was observed for both percentage of days abstinent and drinks per drinking day. Causal chain analyses tested the assumptions underlying these two matching hypotheses. While increased drink refusal skills reported at 9 months among clients with network support for drinking predicted subsequent drinking, CBT did not result in greater self-reported drink refusal skills than did MET. Thus, the breakdown in the CBT causal chain was the failure of CBT to increase drink refusal skills more than MET did. Clients with pretreatment networks supportive of drinking who had networks less supportive of drinking 9 months after treatment initiation drank less often and less intensely subsequently than clients whose network support for drinking did not diminish. However, TSF did not result in a greater reduction in network support for drinking by clients with pretreatment networks supportive of drinking than did MET. Thus, once again, the breakdown in the causal chain was attributed to the failure of treatment, in this case TSF, to have a differential effect on a hypothesized mediator of treatment outcome, network support for drinking. The failure of this causal chain, in the presence of a longer term TSF versus MET matching effect in the outpatient arm of the study, led to a search for another explanation, and participation in Alcoholics Anonymous by TSF clients during followup was identified as a partial mediator. AA participation by clients with pretreatment networks highly supportive of drinking improved their drinking outcomes. This matching effect was most pronounced for clients assigned to TSF and least apparent for those assigned to CBT.

Social support has had an inconsistent role as a variable in alcohol treatment outcome research (Beattie and Longabaugh 1999). Conceptual ambiguity in the use of this construct contributes to this inconsistency (Longabaugh and Beattie 1985, 1986; Beattie et al. 1993; Longabaugh et al. 1993; Beattie and Longabaugh 1999). One important distinction needed is to differentiate general support from alcohol-specific support, that is, support for abstinence or drinking. Historically, these two constructs have been confounded. Consequently, it has not been generally possible to identify the impact that each has on drinking

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outcomes of treatment-seeking clients. However, in the few instances in which alcohol-specific support has been compared with general support as predictors of drinking outcomes, alcohol-specific support has been found to be a better predictor (Beattie et al. 1991; Beattie and Longabaugh 1999; Karno and Longabaugh 1999).

Given this prognostic effect, an important question is whether treatments can be devised that will decrease social support for drinking and, by doing so, decrease drinking. Our prior research has shown that clients varying in alcohol-specific support will have different drinking outcomes as a function of assignment to treatments that vary in amount of relationship-based treatments that include a goal of increasing alcohol-specific support. This research also suggested that clients treated with extended cognitive-behavioral therapy will be less affected by an unsupportive social network (Longabaugh et al. 1995).

The Matching Hypotheses

These results stimulated the development of two matching hypotheses in the present study.

Cognitive-Behavioral Therapy Versus Motivational Enhancement Therapy

Cognitive-Behavioral Therapy (CBT) teaches coping skills for dealing with situations involving high risk for relapse (Kadden et al. 1992). These high-risk situations include those in which a client is exposed to interpersonal encounters where there is pressure to drink, either because people around the client are drinking or because the client is being offered alcohol or being subjected to more subtle pressures to drink.

Motivational Enhancement Therapy (MET) does not attempt to teach the client coping skills but rather how to utilize preexisting resources to set treatment goals and strategies relying on these preexisting skills (Miller et al. 1992). Clients with networks supportive of drinking would not be taught the skills for coping with this network. *Therefore, we hypothesized that clients treated with CBT who had pretreatment social networks supportive of drinking would have better drinking outcomes than comparable MET clients.* For clients having networks that were not supportive of drinking, we did not expect differential drinking outcomes. Thus, an ordinal interaction was hypothesized.

Twelve Step Facilitation Versus Motivational Enhancement Therapy

Twelve Step Facilitation (TSF) treatment, with its aim of involving the client in Alcoholics Anonymous (Nowinski et al. 1992), is conceptualized as a relationship-based intervention that will increase alcohol-specific support for the client. Attendance at AA meetings will expose the client to a large network of people who have a goal of maintaining abstinence and supporting one another in achieving this goal. The AA fellowship's support was expected to assist clients in disengaging from elements of their pretreatment networks that were supportive of drinking. Therefore, TSF would promote support for abstinence both by the client's getting involved in a mutual self-help group supportive of abstinence and by the client's disengaging from a pretreatment social network supportive of drinking.

In contrast, AA involvement is not an important aim of MET. Rather, MET therapists are instructed to support a goal of AA involvement when raised by the client but not to initiate a discussion of this topic. *We therefore hypothesized that to the extent that the client's pretreatment social network was supportive of drinking, assignment to TSF versus MET would result in better drinking outcomes.* Figure 1 portrays the two matching hypotheses as well as the anticipated prognostic effect of a network supportive of drinking.

Network Support for Drinking

Network support for drinking was measured prior to treatment and 9 months after treatment initiation by the Important People and Activities (IPA) instrument (Clifford and Longabaugh 1991). The IPA is a structured interview that asks clients to identify important people in their networks with whom they have had frequent contact within the past 4 months. As implemented in Project MATCH, clients could identify up to 12 people over the age of 12. For

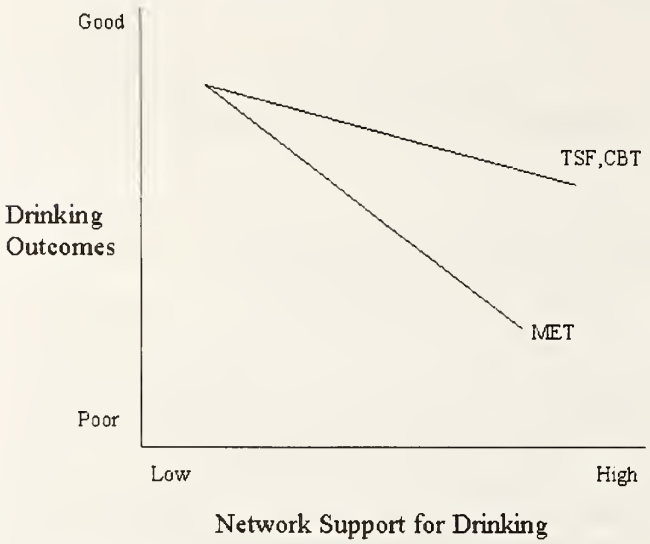

Figure 1. Hypothesized effects of network support for drinking on drinking outcomes.

each person so identified, the client is asked to identify the relationship (e.g., spouse, brother, friend, coworker), along with the duration of the relationship and the frequency of contact with the person. The client is also asked to assess the drinking behavior of each person: how often the person drinks, how much the person drinks on a drinking occasion, and the person's overall drinking status (e.g., heavy drinker, moderate drinker, abstainer). Finally, the client is asked to select from this network the four people who are most important. For each of these four people, the client is asked to rate his or her importance (from totally important to unimportant), how much the client likes the person (totally like to dislike), and how the person behaves in relation to the client's drinking and not drinking: Is the person supportive of drinking, accepting, neutral, not supportive, or nonaccepting? Is the person supportive of the client's not drinking, accepting, neutral, nonsupportive, or nonaccepting?

The interview takes 20–30 minutes to administer. A summary measure of alcohol-specific network support derived from this instrument has previously been found to be prognostic of posttreatment drinking outcome at 1-year followup (Longabaugh et al. 1993). The version of the IPA used in Project MATCH was found to have test-retest reliability over a 2- to 3-day period. With a heterogeneous sample of 70 heavy drinkers and clients who had received treatment, the summary index of overall support for drinking had a Shrout-Fleiss (1979) intraclass correlation of 0.80 and a product moment correlation of 0.95.

Because the version of the IPA used in Project MATCH was revised to suit the purposes of this study, it was necessary to develop a new single summary measure of alcohol-specific support based on this modified instrument. The single measure operationalized to test the alcohol-specific support matching hypotheses involved 11 indices, each standardized to have a mean of 0 and a standard deviation of 1. The values assigned to each index are summed to yield an overall measure of network support for drinking. Three indices focus on the client's investment in the network and eight focus on the network's support of the client's drinking (table 1).

The indices are correlated with one another in predicted directions, but the degree of association is quite modest, average r=0.256. Thus, the overall index is a composite of a fairly heterogeneous set of indices reflecting various dimensions of network support for drinking. However, because of the trialwide need to set the number of tests for each matching hypothesis to a minimum, this summary variable was utilized as the single measure of network support for drinking.

The client's baseline score was used to test the matching hypotheses in each arm of the study. In the aftercare arm, the hypotheses were tested for two periods of observation: during the planned 12 weeks of treatment and during the 12 months following planned treatment completion (months 4–15). In the outpatient arm, because clients were reinterviewed 39 months after treatment initiation, it was possible to test the matching hypotheses at this third period as well. In this interview, monthly drinking data were collected for months 37–39 using the Form 90 (Miller 1996). Therefore, the sample population was the 806 outpatients who had complete outcome data, 84 percent of the 952 outpatients included in the original study.

Alcohol Consumption

Two measures of drinking were designated as primary to test the matching hypotheses:

Table 1: Composite index of network support for drinking

	Investment in the identified network[1]
* Number of People in the Network	The square root of the number of members listed in the overall network, which can range from 0 to 12. The number is squared to provide a more normal distribution.
* Amount of Contact With One's Network	The number of members within the overall network with whom the client has daily contact.
* Average Importance of Most Important People	The average value of "How important this person has been to you" among the people listed as most important.
	Support for drinking[2]
Drinking Status of Network Members	The contact the client has with each member in the network multiplied by the drinking status ascribed to the network member by the client (ranging from abstainer or recovering alcoholic to heavy drinker) and averaged across the network.
Frequency With Which Network Members Drink	The frequency with which each person in the listed network drinks multiplied by the amount of contact the client has with that person, averaged across the entire network.
Maximum Drinking of Network Members on a Drinking Day	The value each person described in the network receives on the variable, "What is the maximum this person drinks on a drinking day" multiplied by the amount of contact the client has with this person.
Percentage of Heavy Drinkers in Network	The number of network members listed as heavy drinkers, divided by the total number of network members listed.
* Percentage of Abstainers and Recovering Alcoholics in Network	The number of network members who are recorded as abstainer or recovering alcoholic, divided by the total number of network members listed.
Most Support for Drinking Among Most Important People	The most supportive reaction to the person's drinking, in response to the question: "How has this person responded to your drinking?" among the people listed by the client as most important.
*Least Support for Drinking Among Most Important People	The least supportive reaction to the person's drinking in response to the question: "How has this person responded to your drinking?" among the people listed by the client as most important.
Average Support for Drinking Among Most Important People	The product of three values for each person listed as most important: how much the client likes the person, how important the person is to the client, and the person's response to their drinking.

*The signs are reversed for indices with asterisks so that all indices have the same direction, with larger scores indicating more support for drinking. The indices are standardized to a mean of 0 and a standard deviation of 1, and a Composite Support Index is created by summing the standardized scores for each of the 11 indices.

[1] Information concerning investment in the person's network is drawn from two sections of the IPA: the client's description of the overall network and of the four most important people in this network.

[2] Information concerning support for the person's drinking is also drawn from two sections of the IPA: the client's description of the drinking behavior and status of the entire network and of the reactions of the most important people to the client's drinking.

percentage of days abstinent (PDA) during a period of observation and drinks per drinking day (DDD). These measures were both transformed to reduce skewness (Project MATCH 1997*a*).

Data Analytic Procedures

As reported elsewhere, a hierarchical latent growth model was used to test for matching effects in each arm of the study for the initial 12-month followup period (Project MATCH 1997*a*; Longabaugh and Wirtz, this volume, pp. 4–17).

Analysis of the 37- to 39-month data for outpatients indicated the data could be combined into a single 3-month data point for the purposes of testing for matching effects present at 3 years. Therefore, to test for the hypothesized matching effect during this followup period, ANCOVAs were conducted separately for each primary drinking variable—PDA and DDD.

To control for rival explanations for results, covariates included the two primary drinking variables measured during the 3 months prior to treatment, treatment site, treatment site by treatment assignment, and treatment site by treatment assignment by pretreatment support for drinking. Independent variables were treatment assignment, pretreatment network support for drinking, and their interaction term (Project MATCH 1998).

Results

Aftercare Arm

CBT Versus MET

No matching effects were observed for the CBT versus MET contrast that were independent of time (tables 2 and 3). While a quadratic time by matching effect for both PDA and DDD was observed during the within-treatment period, in no single week during this period was the matching contrast significant, with or without a Bonferroni correction. There was no support for the hypothesized matching effect of CBT and network support for drinking following treatment either.

Table 2. Hierarchical linear modeling results for within-treatment drinking in the aftercare arm for the Network Support for Drinking matching hypothesis

		MV × Tx		MV × Tx × T		MV × Tx × T^2	
MV × Tx		PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	*t*	.61	-1.21	.58	-1.11	-2.39	2.29
	p	.54	.22	.56	.26	**.016**	**.022**
CBT–TSF	*t*	1.54	-1.36	.96	-.74	-1.03	1.22
	p	.12	.17	.34	.46	.30	.22
MET–TSF	*t*	.69	.08	.22	.51	1.56	-1.29
	p	.49	.93	.82	.61	.12	.20
Overall effect	*F*	1.19	1.16	.40	.66	2.86	2.65
	p	.30	.31	.62	.52	.057	.071

NOTE: MV=matching variable, Network Support for Drinking; Tx=treatment; T=linear time; T^2=quadratic time. *F* tests were used for the overall effect, and *t* tests were used for pairwise treatment contrasts. Reported *p* values are based on nondirectional tests (i.e., two tailed).

Table 3. Hierarchical linear modeling results for posttreatment drinking in the aftercare arm for the Network Support for Drinking matching hypothesis

		MV × Tx		MV × Tx × T		Mv × Tx × T^2	
MV × Tx		PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	*t*	-1.17	-.29	.79	.21	.27	.00
	p	.24	.77	.43	.83	.79	1.00
CBT–TSF	*t*	.12	-.85	-.07	.74	.56	-.38
	p	.90	.40	.94	.46	.57	.71
MET–TSF	*t*	1.29	-.41	-.86	.40	.20	-.31
	p	.20	.68	.39	.69	.84	.76
Overall effect	*F*	.92	.36	.41	.28	.16	.09
	p	.40	.69	.66	.75	.85	.92

NOTE: MV=matching variable, Network Support for Drinking; Tx=treatment; T=linear time; T^2=quadratic time. *F* tests were used for the overall effect, and *t* tests were used for pairwise treatment contrasts. Reported *p* values are based on nondirectional tests (i.e., two tailed).

TSF Versus MET

No matching effects were observed for the TSF versus MET contrast either during the treatment period or in the year following treatment. Thus, there was no support for the hypothesized matching effect of TSF and network support for drinking in aftercare.

Outpatient Arm

CBT Versus MET

There were no significant matching effects observed for the CBT versus MET contrast within treatment, in the 1 year following treatment, or at the 3-year followup (tables 4 and 5). In summary, there was no support for the CBT versus MET by network support for drinking contrast in either arm of the study at any data point.

TSF Versus MET

A matching effect was observed within treatment that changed over time (table 4). During the first 3 weeks of treatment for PDA and the first month of treatment for DDD, clients with networks supportive of drinking who were assigned to TSF were doing less drinking than those assigned to MET, while this was not the case for clients with networks unsupportive of drinking (figure 2). The matching effect was present during the first month of treatment for TSF clients with high network support for drinking, PDA=91 percent, versus MET clients, PDA=82 percent; in contrast, clients with low network support for drinking assigned to TSF and MET did not differ in their PDA: TSF=85 percent, MET=87 percent. This effect was strong enough to survive the Bonferroni correction. However, this initial effect dissipated during the second month of treatment and had totally disappeared by the end of treatment. The effects observed for drinks per drinking day were comparable (not shown).

No matching effect was observed during the 1 year following treatment either (table 5). Rather, network support for drinking had a consistent prognostic effect on drinking outcome. Irrespective of treatment condition, clients with networks supportive of drinking had fewer days abstinent (F=9.74, p<.0018 for PDA and F=8.39,

Table 4. Hierarchical linear modeling results for within-treatment drinking in the outpatient arm for the Network Support for Drinking matching hypothesis

		MV × Tx		MV × Tx × T		MV × Tx × T^2	
MV × Tx		PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	*t*	.35	-.76	-1.88	1.91	-.88	.57
	p	.72	.45	.06	.06	.38	.57
CBT–TSF	*t*	-.42	.15	.92	-.54	-.57	.78
	p	.68	.88	.36	.59	.57	.44
MET–TSF	*t*	-.78	.92	2.85	-2.50	.31	.22
	p	.43	.35	**.004***	**.012***	.76	.82
Overall effect	*F*	.31	.49	4.22	3.46	.39	.32
	p	.74	.61	**.015**	**.032**	.67	.72

NOTE: MV=matching variable, Network Support for Drinking; Tx=treatment; T=linear time; T^2=quadratic time. *F* tests were used for the overall effect, and *t* tests were used for pairwise treatment contrasts. Reported *p* values are based on nondirectional tests (i.e., two tailed). *p<.0125 (refers to the Bonferroni-corrected level of significance for a one-tailed test)

Table 5. Hierarchical linear modeling results for posttreatment drinking in the outpatient arm for the Network Support for Drinking matching hypothesis

		MV × Tx		MV × Tx × T		MV × Tx × T^2	
MV × Tx		PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	*t*	-.98	.50	-1.22	1.52	-.41	.43
	p	.33	.62	.22	.13	.68	.67
CBT–TSF	*t*	-1.71	1.62	-.84	1.75	.67	-1.17
	p	.09	.10	.40	.08	.46	.24
MET–TSF	*t*	-.71	1.11	.39	.21	1.15	-1.61
	p	.47	.27	.69	.83	.25	.11
Overall effect	*F*	1.47	1.38	.77	1.79	.69	1.39
	p	.23	.25	.46	.17	.50	.25

NOTE: MV=matching variable, Network Support for Drinking; Tx=treatment; T=linear time; T^2=quadratic time. *F* tests were used for the overall effect, and *t* tests were used for pairwise treatment contrasts. Reported *p* values are based on nondirectional tests (i.e., two tailed).

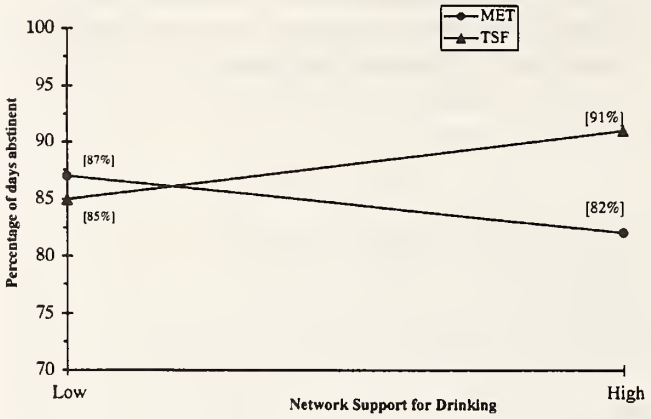

Figure 2. Percentage of days abstinent during first month of treatment: TSF versus MET clients with high and low network support for drinking.

$p<.0039$ for DDD). Thus, it would appear that the temporary buffering effect that TSF provides outpatients during the first month of treatment is overwhelmed by the adverse effect of a network supportive of drinking.

At 3 years followup, however, the matching effect surprisingly reappeared. For PDA, $p=.0057$ (one-tailed test) and for DDD, $p=.0036$. As hypothesized, the effect was attributable to TSF clients with networks supportive of drinking having better drinking outcomes than comparable MET clients, while for clients with networks unsupportive of drinking, treatment assignment did not affect drinking outcome. Clients with high network support for drinking assigned to TSF had more days abstinent (83 percent) than those assigned to MET (66 percent), whereas for those with low network support for drinking, there was no significant difference (TSF=80 percent, MET=83 percent).

In order to achieve a better understanding of why this matching effect reappeared 3 years after treatment, the average PDA and DDD (not shown) were graphed for the three treatments for clients with high and low network support for drinking throughout the entire period of observation starting from month 1 and continuing through month 39 (figure 3). Because the Form 90 (Miller 1996) was not used to collect data during months 16 to 35, averages for this period could not be plotted.

The graph confirms that the matching effect was not present during this initial period of followup. The overall poor prognostic effect of network support for drinking is also evident, as those with low network support for drinking have higher PDA than those with high drinking support. Of note, among clients with high network support for drinking, the MET clients were doing less well than the TSF clients, who were doing about as well as clients with networks not supportive of drinking.

Apparently, between months 15 and 39, MET clients with networks supportive of drinking continued to decline, to 66 percent PDA by 39 months, whereas comparable TSF clients maintained their level of PDA at 83 percent. A comparable pattern emerged for DDD.

A Posteriori Effects: TSF Versus CBT

Support for the hypothesis prompted us to examine post hoc the TSF versus CBT matching contrast. Our question was: Does pretreatment

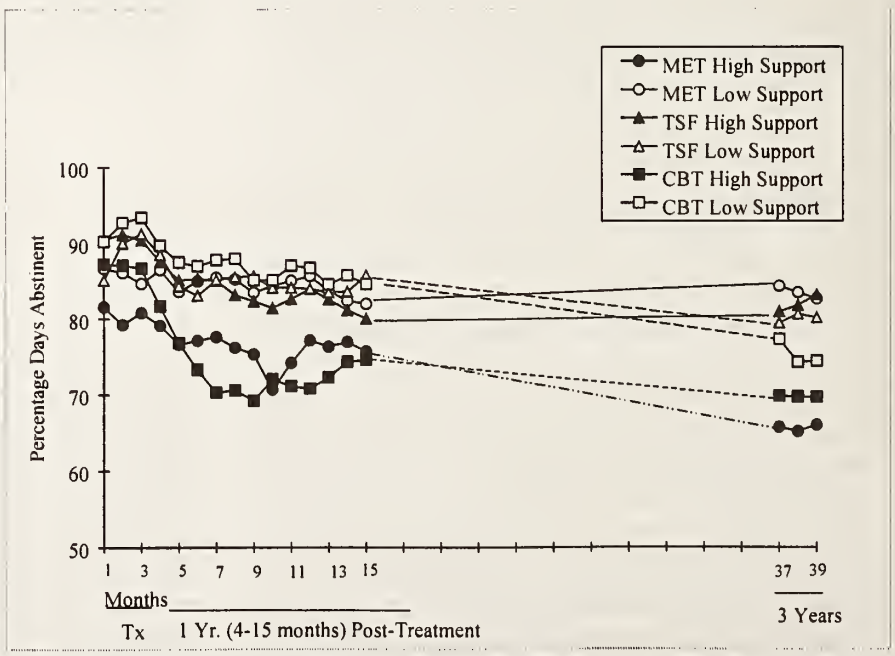

Figure 3. Percentage of days abstinent over entire followup period as a function of Network Support for Drinking and treatment assignment.

network support for drinking interact with TSF versus CBT in the same way as TSF versus MET?

A review of figure 3 suggests that CBT clients with networks supportive of drinking look like comparable MET clients, except during the first 3-month treatment period, when their PDA looks like that of comparable TSF clients. Thus, it appears that CBT is a protective factor for clients with networks supportive of their drinking during treatment. Table 4 supports this picture. The CBT versus MET by network support matching effect interacts with time and approaches a two-tailed unprotected significance level for both PDA ($p<.06$) and DDD ($p<.06$).

Once treatment had ended, however, these CBT clients rapidly declined to a level of PDA comparable to the MET clients. Another look at table 5 provides some statistical support for a TSF versus CBT matching effect that is the result of this decline in MET clients. While the CBT versus MET matching contrast observed during treatment is no longer evident, the CBT versus TSF by network support posttreatment contrast has a two-tailed significance level of $p<.09$ for PDA and $p=.105$ for DDD. The lesser difference between CBT clients with high and low network support for drinking than between MET clients with high and low network support at 3 years suggests that CBT clients are less affected by network support for drinking than are MET clients.

Summary

Tests of the a priori matching hypotheses provided no support for matching aftercare clients to either CBT or TSF versus MET based on their network support for drinking.

When these hypotheses were tested on the outpatient sample, CBT did not protect clients from the adverse effects of network support for drinking any more than did MET, except for a brief period during the beginning of treatment. Similarly, it initially appeared as though TSF protected clients from the adverse effects of network support for drinking only during the first month of treatment. However, drinking reported 3 years later indicated that there was a reemergence of the matching effect for TSF clients who had pretreatment networks supportive of drinking. In contrast to comparable clients in the other two treatments, TSF clients with networks supportive of drinking were able to maintain the abstinence they had achieved by 1-year followup for the subsequent 2 years. In contrast, MET and CBT clients with networks supportive of drinking continued to decline over this 2-year period.

These provocative findings point to the need for an analysis of the causal links underpinning the success and failure of the two matching hypotheses.

Causal Chains

CBT Versus MET

Figure 4 diagrams one putative causal chain underlying the hypothesized superior effectiveness of CBT versus MET for clients with networks supportive of drinking. It was anticipated that by teaching clients cognitive and behavioral skills for coping with interpersonal pressures to drink, CBT would provide clients with coping mechanisms to reduce the risk of drinking in such situations. Specifically, it was hypothesized that clients assigned to CBT would be taught drink refusal skills which they would then utilize in high-risk social situations, resulting in more days abstinent and fewer drinks per drinking day. As clients with networks supportive of drinking would more often be exposed to these high-risk social situations, they would be more likely to benefit from this skill acquisition than clients with networks unsupportive of drinking prior to treatment. Change in drink refusal behavior from pretreatment to posttreatment was measured by self-report items on the self-efficacy confidence and temptation instrument (DiClemente et al., this volume).

Tests of the drink refusal causal chain occurred in two steps. First, examination of the relationship between drinking and change in drink refusal skills indicated that increased drink refusal skills from baseline to 9 months was significantly related to decreased drinking frequency ($p=.0001$) and intensity ($p=.0001$). However, in the second step tested, there was no relationship between increase in drink refusal skills and CBT versus MET treatment assignment. Thus, the causal chain indicated that the

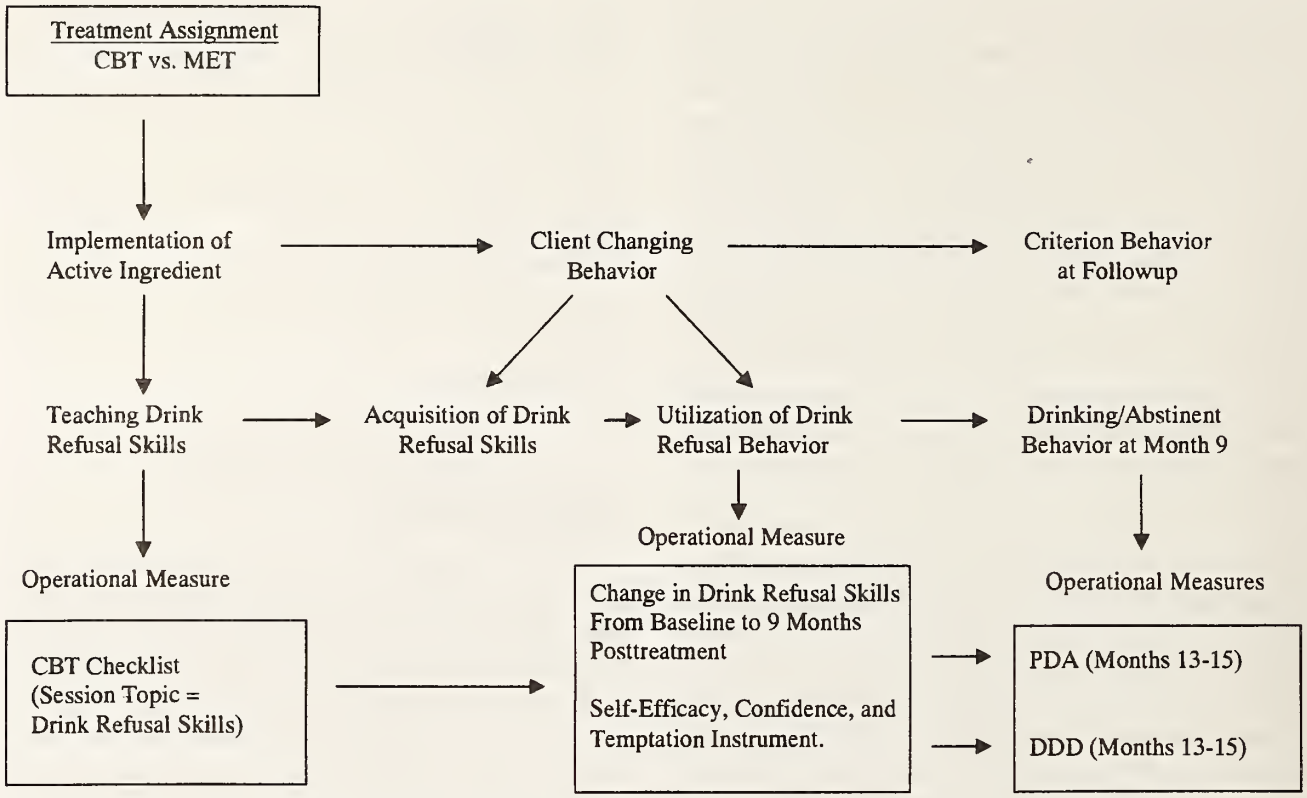
Treatment Assignment
CBT vs. MET
Implementation of Active Ingredient
Client Changing Behavior
Criterion Behavior at Followup
Teaching Drink Refusal Skills
Acquisition of Drink Refusal Skills
Utilization of Drink Refusal Behavior
Drinking/Abstinent Behavior at Month 9
Operational Measure
Operational Measure
Operational Measures
CBT Checklist (Session Topic = Drink Refusal Skills)
Change in Drink Refusal Skills From Baseline to 9 Months Posttreatment
Self-Efficacy, Confidence, and Temptation Instrument.
PDA (Months 13-15)
DDD (Months 13-15)

Figure 4. CBT versus MET, causal chain analysis, increased drink refusal skills

failure was in CBT's not increasing drink refusal skills more than did MET. Those who reported an increase in confidence in using these skills, in fact, did have fewer drinking days and less intensive drinking on drinking days.

TSF Versus MET

The A Priori Causal Chain

Figure 5 displays the putative causal chain for TSF clients. Because of the TSF therapist's support for client involvement in AA, TSF clients would be more likely to be involved in AA than would MET clients. This greater AA involvement, in turn, would lead to a decrease in network support for drinking posttreatment (measured at 9 months by a readministration of the IPA). This reduction in network support for drinking would in turn result in decreased PDA and DDD by months 13–15. Because network support for drinking is problematic for clients, those with networks highly supportive of drinking prior to treatment would benefit more from this reduction in network support for drinking than would those whose networks were unsupportive of drinking.

This causal chain was tested in two steps. First, the change in network support for drinking from pretreatment to 9 months was related to the two drinking measures during months 13–15. The results indicate a highly significant relationship between change in network support for drinking and change in drinking. Clients whose network support for drinking had declined between baseline and 9 months reflected significantly greater decreases in drinking intensity and frequency than those whose network support for drinking had increased.

However, in the second step, which tested the relationship between treatment assignment to TSF versus MET and change in network support for drinking, we found no association between these two measures. TSF did not lead to a greater decrease in overall network support for drinking than did MET.

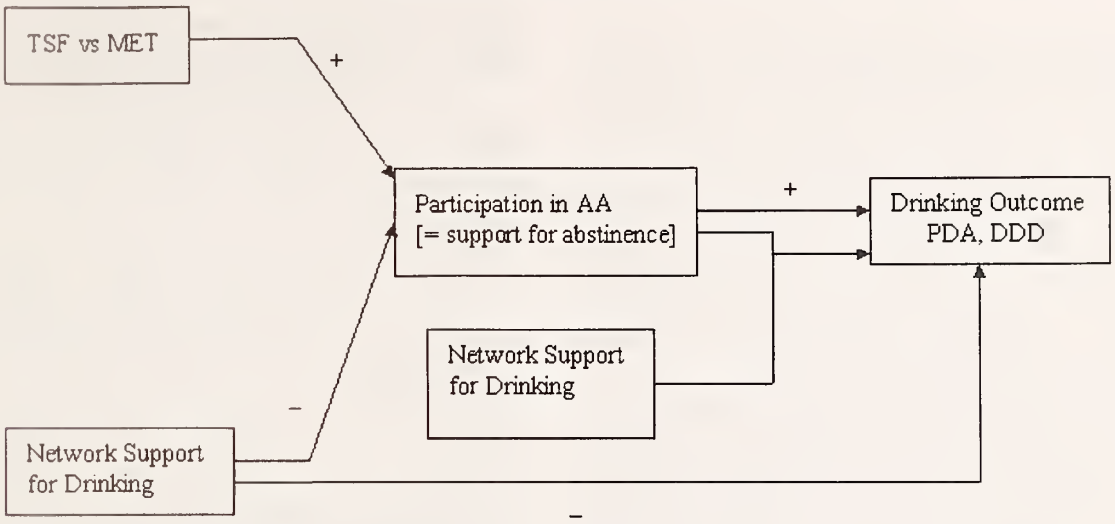

Figure 5. Causal chain for TSF versus MET by network support for drinking matching effect

Thus, as was the case with the CBT causal chain, treatment assignment failed to lead to differential changes in the putative mediating variable. And, as was also the case with the CBT causal chain, clients who reported positive change in the mediating variable—in this case, a network less supportive of drinking—did in fact also report better drinking outcomes. The failure of the matching hypotheses during this period appears to be attributable at least to the failure of the CBT and TSF treatments to bring about the greater changes anticipated.

The A Posteriori Causal Chain

Given the evidence for the long-term support for the treatment matching effect, our focus turned to identifying a causal chain that mediated this effect. How does it happen that TSF clients with networks supportive of drinking have increasingly better drinking outcomes than either MET or CBT clients with networks supportive of drinking, whereas for those with pretreatment networks unsupportive of drinking, such a differential effect is not evident? What does TSF have that CBT and MET lack that would differentially affect clients with high and low network support for drinking? What TSF ingredient would increase in impact as the time between formal treatment completion and followup observation increases?

The most obvious candidate for a mediating variable is AA participation itself, one of the two goals for TSF treatment not shared by either CBT nor MET. If a client does indeed become involved in AA, exposure to this social network is in itself highly supportive of abstinence, irrespective of any wider impact that AA involvement might have on the broader social network of the client.

We therefore revised the causal chain, as follows: First, clients with networks supportive of drinking prior to treatment will have fewer days abstinent after treatment than clients with networks unsupportive of drinking. Second, clients having networks supportive of drinking will also be less likely to participate in AA. Third, however, because of the primary aims of TSF, clients assigned to TSF would be more likely than clients assigned to either MET or CBT to participate in AA, irrespective of pretreatment network support for drinking. Fourth, we stipulate that clients participating in AA will have greater support for abstinence than those who do not participate.

Therefore, AA participation will reduce the negative impact of network support for drinking on posttreatment abstinence. This effect will be greatest for clients with pretreatment networks more supportive of drinking. Therefore, the greater AA participation of such clients in TSF will mediate the observed matching effect of the combination of TSF treatment assignment and network support for drinking on drinking outcome.

To conduct this analysis, we included a measure of AA participation, namely, the number of days the client reported going to meetings throughout the initial 3 months of treatment and during the year that followed. These data were collected by self-report through the Form 90 (Miller 1996). Number of days of attendance were summed and divided by the number of days within the period of observation to yield a percentage of available days within a period in which the client attended meetings.

For purposes of the causal chain analysis, the variable was dichotomized into high and low AA participation. Prototypically, a high AA participant attended AA on more than 20 percent of the days during the treatment period and about 16 percent during the year following treatment. In contrast, low AA participants attended fewer than 20 percent of days during the treatment period and stopped attending AA in the year following. Measures of attendance have been criticized as a poor proxy for operationalizing AA involvement (Tonigan et al. 1996). For this reason, we also used a measure of involvement in AA provided by the Alcoholics Anonymous Involvement (AAI) questionnaire (Tonigan et al. 1996). The results of this analysis have been reported elsewhere (Longabaugh et al. 1998). Only small differences were observed between the results of using these alternative measures of AA involvement.

Results

Network support for drinking is a prognostic indicator of fewer posttreatment days of abstinence and more drinks per drinking day during months 37–39 (PDA, p=.03; DDD, p=.01, one-tailed tests). Thus, the first step in the causal chain is supported.

Table 6 displays AA participation as a function of pretreatment network support for drinking and treatment assignment. Network support for drinking decreased the participation of a client in AA: 46 versus 54 percent (p<.0003), as hypothesized in the second step of the causal chain. Nevertheless, also as predicted, assignment to TSF resulted in greater AA participation than assignment to MET or CBT: TSF=75 percent versus MET, 38 percent, or CBT, 35 percent (also highly significant). Most pertinent, for those with high network support for drinking, TSF resulted in 70 percent AA participation versus only 37 percent for MET clients and 28 percent for CBT clients. Thus, the third step in the causal chain was supported. TSF leads to higher AA participation by clients with networks supportive of drinking than does either CBT or MET.

Table 6. AA participation months 1–15 as a function of network support for drinking and treatment assignment

MV/AA participation	CBT *N*	MET *N*	TSF *N*	Total *N*
Low support				
Low	83	92	33	208
High	62	61	125	248
% high participants	42.6%	39.9%	79.1%	54.4%
High support				
Low	105	95	48	248
High	40	55	114	209
% high participants	27.6%	36.7%	70.4%	45.7%
All participants				
Low	188	187	81	456
High	102	116	239	457
% high participants	35.2%	38.3%	74.7%	50.0%
Total	290	303	320	913

NOTE: MV=matching variable, Network Support for Drinking

The next link in the causal chain was to test whether greater participation in AA by TSF clients with high network support for drinking accounted for the matching effect that high network support for drinking clients assigned to TSF have better drinking outcomes at 3-year followup.

The test was conducted by a series of multiple regression analyses. In the first analysis, after entering the appropriate covariates, the product term of TSF versus MET was entered into the predictor equation, along with the network and treatment variables. In the second analysis, a third-order interaction term was created by the product of network support for drinking,

treatment condition, and AA participation. This term was added to the prior variable set. If AA participation were mediating the observed matching effect, we would expect to find that partialing out this effect would reduce or decrease to nonsignificance the strength of the relationship between the treatment assignment for these clients and their drinking outcomes.

As can be seen from table 7, when the effect of differential AA participation is partialed out of the relationship between treatment assignment and PDA for each of the three groups, only one group is markedly affected. As anticipated, the PDA of clients with high network support for drinking who were assigned to TSF was reduced by 7 percent when the effect of their AA participation was partialed out. In all other groups, there was only a small change. Once the effect of AA participation was removed from this group, their PDA was significantly reduced. (The one-tailed p value dropped from .0053 to .04.) Thus, AA participation by clients with networks highly supportive of drinking was a partial mediator of the observed matching effect. That the p value remained significant, at a reduced level, indicates that other partial mediators, still to be identified, were also operative.

The difference in PDA for those with networks supportive of and nonsupportive of drinking who did and did not participate in AA was largest for clients assigned to TSF. Clients with networks highly supportive of drinking who nevertheless participated in AA averaged 90 percent PDA at 39 months. Those not participating in AA had a PDA of only 61 percent, a 29-percent difference. In contrast, for those with networks unsupportive of drinking, AA participants had a PDA of 81 percent, while those not participating in AA had a PDA of 76 percent, only a 5-percent difference.

The same pattern held for MET clients. For clients with networks supportive of drinking, those who participated in AA had an average 39-month PDA of 80 percent, whereas those who did not averaged a low PDA of only 55 percent, a difference of 25 percent. Again, in contrast, for those with networks unsupportive of drinking the difference was less, with those participating in AA having a higher PDA of 90 percent than those who did not, 77 percent, a 13-percent difference.

Finally, for clients assigned to CBT, the relationship was also apparent. CBT clients with networks supportive of drinking who participated in AA had a 39-month PDA of 82 percent, while those not participating had a PDA of 65 percent, a 17-percent difference. In contrast, clients with networks unsupportive of drinking differed less in their PDA as a function of AA participation. AA participants had an average PDA of 80 percent, while nonparticipants had an average PDA of 70 percent, only a 10-percent difference.

In summary, the causal chain developed to explain the long-term TSF versus MET/CBT matching effect was supported. Clients with networks supportive of drinking prior to treatment are less likely to become involved in AA than clients with networks unsupportive of drinking. However, TSF increased the probability of clients being involved in AA. This was true irrespective of pretreatment network support for drinking. Participation in AA, in turn, was associated with more abstinent days. Partialing out this effect from the relationship of pretreatment network support by treatment matching effect to drinking at months 35–37 reduced the significance of the relationship, thus indicating that AA participation is a partial mediator of this matching effect.

Table 7. Average percentage of days abstinent in month 39, before and after partialing out the effects of AA participation

MV/AA participation	Treatment		
	TSF	MET	CBT
High support			
Included	83	66	70
Partialed out	76	68	73
Difference	-7	+2	+3
Low support			
Included	80	83	74
Partialed out	79	84	75
Difference	-1	+1	+1

NOTE: MV=matching variable, Network Support for Drinking.
TSF/network support verses MET/network support contrast: p value reduced from .0053 to .04.

Given the causal chain support for the TSF versus MET matching hypothesis at 3-year followup, the obvious questions to be addressed are:

- Why did this matching effect not appear earlier in the outpatient group?
- Why did this matching effect not appear in the aftercare sample?

In order to examine these questions, we tested the AA participation causal chains for the earlier posttreatment periods separately for clients in the outpatient and aftercare arms, substituting the last 3 months of posttreatment drinking measures (months 13–15) for the 37–39 month measure indexing the 3-year outcomes.

Outpatient 1-Year Posttreatment

When the TSF versus MET by network support for drinking matching effect was tested for months 13–15, no evidence for matching appeared. When regression analyses were conducted to include the product term of AA participation by treatment by network support for drinking, this product term had no main effect on PDA, thus confirming that AA participation was not interacting with treatment and support to enhance the outcomes of TSF clients with networks supportive of drinking. With AA participation excluded from the analysis, the negative effect of network support for drinking on MET clients was slightly but nonsignificantly greater than for TSF clients. When AA participation was factored in, both MET and TSF clients with networks supportive of drinking did equally well when AA participation was high. When AA participation was low, both treatment groups did increasingly poorer with increasing network support for drinking. Thus, the higher order product term had no mediating effect.

Aftercare 1-Year Posttreatment

These analyses were repeated for the aftercare sample. As above, we found no evidence that PDA during months 13–15 was affected by matching network support for drinking to TSF versus MET treatment. When the product term factoring in AA participation was entered, those with high AA participation in both treatments did equally well and better than those with low AA participation. MET clients tended to have better PDA than TSF clients when network support for drinking was high.

Discussion

The failure of the CBT versus MET matching hypothesis is consistent with the breakdown in its underlying causal chain. While clients reporting greater drink refusal coping skills in social situations had better drinking outcomes, assignment to CBT did not result in a reported greater utilization of these pertinent skills at 6 months after treatment completion. It would thus appear that increased social coping skills is not a unique contribution of CBT. This finding is consistent with that recently reported by Finney and colleagues (1998). These investigators conducted a naturalistic study of Veterans Administration treatment programs that had either a 12-step orientation, a CBT orientation, or were eclectic. Results showed that TSF and eclectically treated clients were as likely to report increased coping skills as those treated in CBT. It then follows that clients especially in need of such skills will not incrementally benefit from CBT therapy. This conclusion is consistent with a review of CBT's putative active ingredients as mediators of CBT effectiveness with alcohol-dependent clients (Morgenstern and Longabaugh 2000). These investigators found that increased social skills did not mediate the effectiveness of CBT versus treatments against which it has been compared.

In contrast, a TSF by network support for drinking matching effect was observed to emerge over an extended period of followup for outpatients. Even though TSF clients did not show a differential change in their everyday social network's support of their drinking, they did participate in AA to a greater extent than did their MET and CBT counterparts. For clients with pretreatment networks supportive of drinking, participation in AA eventually reduced the influence of this network on their drinking. Thus, AA participation was implicated as at least one of the active ingredients mediating this matching effect. Therefore, to

the extent that a treatment is successful in getting outpatient clients with high network support for drinking involved in AA, their drinking outcomes should be improved.

AA participation is an important correlate of successful drinking outcomes of clients with pretreatment networks supportive of drinking across all three treatment conditions but is less influential in producing good drinking outcomes for those with social networks unsupportive of drinking prior to treatment. Here, AA participation is positively associated with good drinking outcomes but much less strongly so.

Further Research Questions

While a host of further research questions arise from these findings, five are especially pressing.

1. Methodological review. In order to test the a priori matching hypothesis, it was necessary to combine a multidimensional construct of support for drinking into a single measure. The indices which go into making up this overall index are only moderately correlated, and it is possible that some dimensions of support for drinking are more important than others for measuring support and its influence on drinking outcomes.

   While two indices of drinking have served to measure treatment outcome, it is important to assess whether any of the matching effects reported for these two drinking measures generalize to other dimensions of outcome.

   In measuring AA involvement, we confined this report to a measure of AA attendance summed over the initial 15 months. We have elsewhere reported (Longabaugh et al. 1998) the results of using a more sophisticated measure of AA involvement developed by Tonigan and colleagues (1996). Much to our surprise, the effect of this more elegant measure of AA involvement, while also observed to be a partial mediator of the matching effect, was not as robust. AA involvement measured by the AAI scale incorporates two dimensions of AA affiliation, working the program and participation in the Fellowship. AA attendance may be a purer measure of social support than AA involvement, which confounds affiliation and working the Twelve Steps. As the AAI scale measures both of these dimensions, further analysis should discern whether these two components contribute differentially to mediating this matching effect.

2. Within the present analysis, AA participation was measured as a single variable covering the entire period of followup. It will be important to separate participation into different blocks of time in order to isolate which periods of participation have the largest impact on outcome and whether incremental gains are made by the addition of other time blocks. While the effects of AA involvement were apparent 3 years after treatment, AA participation itself did not differ for the three treatment groups at 3 years (Tonigan et al. in press). An important question to address therefore is how long AA participation must continue in order to reap these beneficial effects, especially for those clients with networks supportive of drinking. As Tonigan has reported elsewhere (in press), AA participation is highest during treatment and diminishes as time from treatment completion increases. Our matching finding would suggest that while AA participation is diminishing as time from treatment completion increases, the benefit to be gained by clients with networks supportive of drinking is nevertheless increasing for those who have participated in AA.

3. Still another question to be addressed is that of gaining a more comprehensive understanding of clients affected by the matching process. What other client characteristics increase the likelihood of those with networks supportive of their drinking becoming involved in AA? We have observed that clients assigned to TSF were most likely to participate in AA. Drinking outcomes were best for those who did participate, but those who did not participate in AA, despite the TSF push, had the poorest outcomes. In contrast, clients who were assigned to MET and CBT had much less likelihood of participat-

ing in AA, but the drinking outcomes for those who did not participate were not as bad as those observed among the high network support for drinking/low AA participants in TSF.

If we can identify other characteristics besides network support for drinking that reduce the likelihood of clients utilizing AA, we could plan treatments particularly suited to these types of clients. This would improve overall treatment effectiveness by triaging AA-aversive clients with networks supportive of drinking to other kinds of treatment interventions.

4. We also need to examine the causal chain in greater detail in order to identify what in the experience of the client leads to the emergence of this matching effect 3 years after treatment. It is tantalizing that a matching effect observed during the first month of treatment disappears only to reemerge 3 years later. This suggests that some kind of dynamic process is active which unfolds over time. Our initial hypothesis is that clients with networks supportive of drinking are thrown into great conflict when assigned to TSF with its goal of AA client involvement. Perhaps they do so during the first month of treatment, but then the everyday influence of their preexisting network pulls them away from this support group. They may subsequently relapse or gradually increase their alcohol involvement over time. After sufficient adverse effects from drinking recur, some of these clients may return to AA as a posttreatment resource to assist them in regaining a more trouble-free lifestyle.

5. Finally, as differential AA participation does not fully explain the observed TSF versus MET matching effect for clients with high network support for drinking, what other factors are involved? What other causal chains may be identified?

Conclusions

The TSF versus MET by network support for drinking matching hypothesis was confirmed at 3 years posttreatment. This matching effect accounted for a 17-percent difference in PDA between clients with networks supportive of drinking who were assigned to TSF and MET. Not hypothesized but evident in the results, CBT compared as unfavorably for clients with networks supportive of drinking as did MET.

Causal chain analyses revealed that this matching effect did not emerge earlier during the posttreatment period because TSF clients with networks unsupportive of drinking were as helped by AA attendance as those with networks supportive of drinking. Additionally, in aftercare, MET clients participated in AA to nearly the same extent as did TSF clients, no doubt because of the influence of the preceding inpatient or day hospital treatments that had already exhorted the client to become involved in AA.

Because AA is a partial mediator of this matching effect, it can be incorporated as an active ingredient into treatments other than TSF, with the likelihood that client outcomes in these other treatments will be enhanced.

It is notable that this matching effect was one of the few observed in Project MATCH. Because the present matching hypothesis was also one of the few that were predicated on a causal chain that involved variables outside of the therapy itself, this suggests that if matching effects are to be observed, they need to take into account the social context in which treatments occur.

In contrast, the CBT matching hypothesis relied upon changes that were to occur within the treatment itself which were anticipated to be generalized to in vivo experience. However, evidence for this matching effect was only a trend and limited to the within-treatment period in the outpatient arm, which reinforces the belief that to be successful, treatment must go beyond changes that may take place only in treatment.

Acknowledgments

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Prior Alcoholics Anonymous Involvement and Treatment Outcome

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ABSTRACT

This chapter addresses the relationship between clients' prior exposure to Alcoholics Anonymous (AA) and their response to three psychosocial treatments for alcoholism: Cognitive-Behavioral Coping Skills Therapy (CBT), Motivational Enhancement Therapy (MET), or Twelve-Step Facilitation Therapy (TSF). It was predicted that clients with higher levels of previous AA involvement would have better outcomes in the TSF treatment condition because of that treatment's AA orientation. Weaker relationships between prior AA involvement and outcome were predicted for the CBT and MET treatments. Preliminary analyses showed that AA involvement prior to treatment overall was not systematically related to posttreatment percentage of days abstinent or drinks per drinking day among either the outpatient or aftercare populations sampled. Tests of the matching hypothesis provided no support for the predicted match among either the outpatient or aftercare clients. Analyses exploring the causal chain presumed to underlie the hypothesized matching effect provided little support for the proposed causal chain links. These findings suggest that the efficacy of these three treatments is not significantly altered by clients' prior exposure to AA.

Alcoholics Anonymous (AA) is the most popular mutual-help program for people experiencing alcohol problems, and estimates of current 12-step meeting attendance rates in North America range from 1.7 million (Alcoholics Anonymous 1990) to 3.5 million (Room 1993) per year. Historically, AA has influenced the conduct and goals of professional treatment of alcoholism in the United States and, in turn, AA membership has increased because of professional referral to AA (Makela 1996). The extent of interplay between AA and professionals is probably best evidenced in the current and lively discussion about whether AA is an adjunct to formal treatment wherein gains made in formal treatment are sustained by continued AA affiliation or, instead, AA should be regarded as offering unique benefits essential to recovery from alcoholism (Freimuth 1996).

In the context of the mutually beneficial albeit sometimes tense relationship between professionals and AA, it is surprising (and disappointing) that so little effort has been made to understand how, if at all, congruity in therapeutic orientation and prior exposure to AA principles may influence drinking outcome. Emrick and colleagues (1993), for example, found virtually no relationship between prior AA attendance and drinking outcome after formal treatment (r weighted=0.05), but their combining of findings from 12 studies ignored the nature of the professional treatment clients received in each study. Congruity between client expectations about what treatment ought to be (or ought not to be) may influence client treatment satisfaction and outcome. The extent to which clients received what they wanted (at intake) has been found to predict better alcoholism

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treatment outcomes, whereas the delivery of unwanted services may have little or no impact.

Pragmatically, treatment providers encounter individuals with prior AA exposure. Here, exposure refers most immediately to AA attendance, although the term is inclusive and may involve such activities as reading AA literature. While exact estimates of the percentage of clients with AA exposure immediately before treatment are problematic to derive, the percentage of clients with prior *lifetime* AA exposure is certainly high (estimated at 77 percent by the Project MATCH Research Group 1997). Thus, the importance of AA for professionals is not restricted to referral and encouragement to meetings. The AA membership survey, for example, reported that 62 percent of AA members (sampled) reported seeking formal therapy after becoming members of AA and achieving sobriety (AA Membership Survey 1997).

One matching hypothesis in Project MATCH (1993, 1997) specifically addressed the congruity of professional treatment approaches with clients' prior AA exposure. *We predicted that clients with higher levels of previous AA involvement would fare better in a Twelve Step Facilitation (TSF; Nowinski et al. 1992) treatment condition because of its AA orientation. In terms of the two primary dependent measures in the Project MATCH trial, we predicted that posttreatment percentage of days abstinent (PDA) and prior AA involvement would be positively related for those clients assigned to the TSF condition, and that drinks per drinking day (DDD) would be negatively related with prior AA involvement for TSF clients. Within the other two treatments of the Project MATCH trial—Cognitive-Behavioral Coping Skills Therapy (CBT; Kadden et al. 1992) and Motivational Enhancement Therapy (MET; Miller et al. 1992)—we predicted that a weaker relationship would be found between prior AA involvement and drinking outcomes.*

Causal Chain

Our predictions were based on the following assumptions:

- Higher prior AA engagement would be associated with more positive client attitudes about the goals and tasks in the TSF treatment condition.
- Increased acceptability of the TSF modality would also be reflected in stronger client-therapist relationship bonding.
- Greater commitment to the TSF therapeutic process would, in turn, result in higher rates of both treatment session completion and AA attendance during treatment.
- Heightened compliance with the TSF protocol and AA would translate into higher rates of posttreatment AA attendance, which, in turn, would result in more favorable drinking outcomes.

Operationalization of the Matching Variable

Central to the formulation of our hypothesis was the development of a conceptual framework to define AA involvement, followed by selection of a measure with known psychometric characteristics. Our intent was to measure the extent of prior commitment to AA, rather than just AA attendance. The core literature of AA (Alcoholics Anonymous 1976, 1981) specifies two domains of AA experience. On the one hand, the *program* of AA, compactly summarized in the 12 Steps and Traditions of AA, includes prescriptions for achieving sobriety and for conducting one's life. On the other hand, the practice of AA, often described as the AA *fellowship*, includes the ways in which AA members relate to one another as well as how AA group interactions are perceived by members. Montgomery and associates (1993) found that AA groups differ significantly in perceived group dynamics (fellowship), and Tonigan et al. (1995) reported that differences in AA group dynamics were predictive of the extent to which the 12 Steps of AA were discussed in meetings (program).

Composite measures of AA involvement seem to have more utility than single-item measures but often have sampled a small range of behaviors. Snow and colleagues (1994) emphasized social relationships as a measure of AA commitment and largely ignored progress in working the AA steps, a central element of the AA program. On the other hand, Gilbert (1991) ignored

social support within AA and measured progress in AA step work, thus excluding consideration of the AA fellowship. It seems sensible to sample involvement in both the AA program and fellowship when measuring the construct of AA involvement.

Instrumentation

The AA Involvement (AAI) scale developed for Project MATCH consists of 13 items designed to measure lifetime and more recent participation in AA. The inventory includes some items pertaining to the AA program (e.g., step work) and others reflecting commitment to the AA fellowship. In a test-retest substudy of the Project MATCH trial, the AAI was found to have good internal consistency and test-retest reliability (Tonigan et al. 1996) and, based upon the intake Project MATCH sample (N=1,726), support was found for the multidimensional nature of engagement in AA.

As a validity check of our composite AAI measure, we plotted by study arm lifetime and recent AA involvement (based on intake AAI data) against reported attendance at AA meetings in the 90 days prior to study recruitment, as reported in the Form 90 interview (Miller 1996). Figure 1 shows the nature of the relationship between these measures at intake for the aftercare and outpatient samples. Recent AA attendance was a reasonable proxy of more general AA involvement under conditions of low to moderate involvement, but AA involvement plateaued at higher levels of attendance—above 40 percent of days (or about 3 meetings a week). Not shown, this same significant quadratic relationship was found at each followup point in both study arms of Project MATCH, although with time, the nature of the quadratic relationship became somewhat shallower.

Results

About 7 percent (n=69) of Project MATCH outpatients did not provide sufficient information to compute a composite intake AAI score, with a somewhat lower percentage of missing cases (5 percent, n=33) in the aftercare arm. No between-treatment mean differences were found in intake AAI scores within either arm

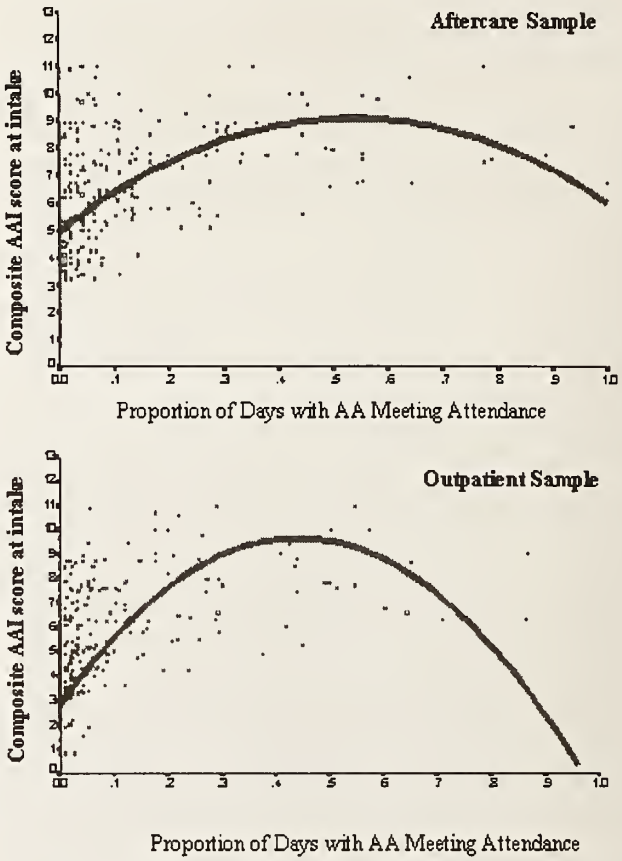
Aftercare Sample
Composite AAI score at intake
Proportion of Days with AA Meeting Attendance
Outpatient Sample
Composite AAI score at intake
Proportion of Days with AA Meeting Attendance

Figure 1: Relationship between self-reported AA attendance and involvement at intake: Project MATCH aftercare and outpatient samples

but, on average, aftercare clients reported significantly higher prior AA involvement (M=5.37, SD=2.33) than outpatient clients (M=3.38, SD=2.48), p<.001. At least some lifetime AA attendance was reported by 64 percent of the outpatient and 91 percent of aftercare clients.

Aftercare Sample

Prognostic Effects

The prognostic effects of the AAI secondary matching variable were also assessed in a hierarchical linear modeling (HLM) context that controlled for study site, treatment condition, and linear and quadratic time main effects as well as their interactions with each other and with AAI. Four analyses were conducted, one for each primary dependent measure (transformed PDA and DDD) and separately within study arm (outpatient and aftercare). A more

detailed description of the analytic strategy is provided by the Project MATCH Research Group (1997) and Longabaugh and Wirtz (this volume, pp. 4–17).

For aftercare clients, AA involvement prior to treatment was unrelated to abstinence (PDA) during 12 months of followup, with some variation in the relationship between AAI and PDA across the five aftercare sites ($p<.06$). Examination of scatter plots indicated that in two aftercare sites the relationship between intake AAI and followup PDA was positive ($r=0.19$ and 0.10), whereas at the other three sites it was negligible or negative ($r=-0.05$, -0.08, and -0.11). The prognostic effect of prior AA involvement on intensity of drinking (DDD) during the 12 months of followup approached statistical significance ($p<.06$) in the direction opposite to our prediction. Specifically, clients with more prior AA involvement reported *higher* levels of drinking intensity during early followup. Variability across aftercare sites ($p<.054$) and time ($p<.01$) was again observed. At three aftercare sites, for example, the relationship between prior AA involvement and intensity of drinking during the first 6 months of followup was significant and positive, ranging from r's=0.29 to 0.19, while at the remaining aftercare sites the relationship was negligible, r's ranging from 0.03 to 0.01.

Matching Hypothesis

The analytic strategy for testing of the matching hypotheses and protection of type-1 error rate are described elsewhere in this volume (Longabaugh and Wirtz, pp. 4–17). Succinctly, HLM models similar to those for testing the prognostic effect of matching variables were applied, and three statistical tests of slopes were evaluated in possible rejection of the null hypothesis. These were: (1) an overall matching effect collapsing across time, (2) a matching effect by linear time interaction, and (3) a matching effect by quadratic time interaction. We predicted a more positive slope for AAI and outcome during the 12 months of followup within the TSF condition than within the combined CBT and MET conditions.

Inspection of table 1 shows that the a priori overall matching effect was not supported either during treatment or across the 12 months of followup (all p's >.10). During the 12 weeks of treatment, however, an AAI by treatment by linear time interaction was found on both dependent measures (PDA and DDD), but this effect was opposite to the prediction: clients assigned to TSF with higher AAI scores tended to have increasingly fewer abstinent days per week and drank more heavily as treatment continued than comparable clients assigned to CBT and MET conditions. This finding did not persist into the posttreatment phase of the study. Inspection of the unplanned pairwise contrasts in table 1 likewise indicated no presence of an AAI moderating effect on treatment response.

Table 1. Summary of aftercare HLM of Alcoholics Anonymous Inventory tests: Probability values associated with tests during and after treatment

	Predicted match TSF vs. MET/ CBT	Unplanned matching contrasts		
		TSF–CBT	TSF–MET	CBT–MET
During treatment				
PDA	.63	.47	.90	.56
PDA linear	**.03***	.06	**.05**	.87
PDA quadratic	.65	.36	.91	.30
DDD	.13	.09	.37	.43
DDD linear	**.01***	**.04**	**.03**	.78
DDD quadratic	.21	.27	.29	.99
After treatment				
PDA	.65	.82	.58	.74
PDA linear	.18	.29	.21	.83
PDA quadratic	.34	.12	.90	.16
DDD	.81	.96	.65	.61
DDD linear	.15	.17	.26	.83
DDD quadratic	.90	.60	.76	.40

* opposite direction

Causal Chain Analyses

Where did our predictions fail? To explore this question we examined the causal chain underlying our hypothesis. Figure 2 shows the path analysis testing our causal model for the two aftercare groups contrasted in the AAI matching hypothesis. Partial correlation

coefficients are provided beside each arrow, and each coefficient controls for relationships of equal or prior temporal order (left to right).

Hierarchical multiple regression analyses were conducted to determine whether parallel links (slopes) in the two models in figure 2 were different from one another. These analyses controlled for site variation as well as for the main effect of treatment and the matching variable. None of the three therapeutic alliance measures (goal compatibility, task compatibility, relationship bonding) supported our prediction of a differential relationship (all interaction p values >.05). For clients assigned to TSF and the combined CBT and MET conditions alike, there was an equivalent negative relationship between prior AA involvement and client agreement on therapeutic tasks. Extent of prior AA involvement was virtually unrelated to therapist bonding in both groups, and agreement with therapeutic goals was modestly and positively related to prior AA exposure in both groups.

Six interactions were tested in determining whether the slopes between the three therapeutic measures and AA meeting attendance and percentage of therapy attended variables were different between the TSF and combined CBT and MET path models. While substantial variability was found in parallel links (e.g., 0.13 versus −0.10), none of these slope contrasts exceeded chance variation (smallest obtained p value=.28). As predicted, AA meeting attendance during treatment was a strong predictor of posttreatment AA attendance which, in turn, predicted both primary dependent measures at both proximal and distal followup periods. Not anticipated, this prediction was manifest in about the same magnitude in both the aftercare TSF and combined CBT and MET conditions (nonsignificant slope contrast).

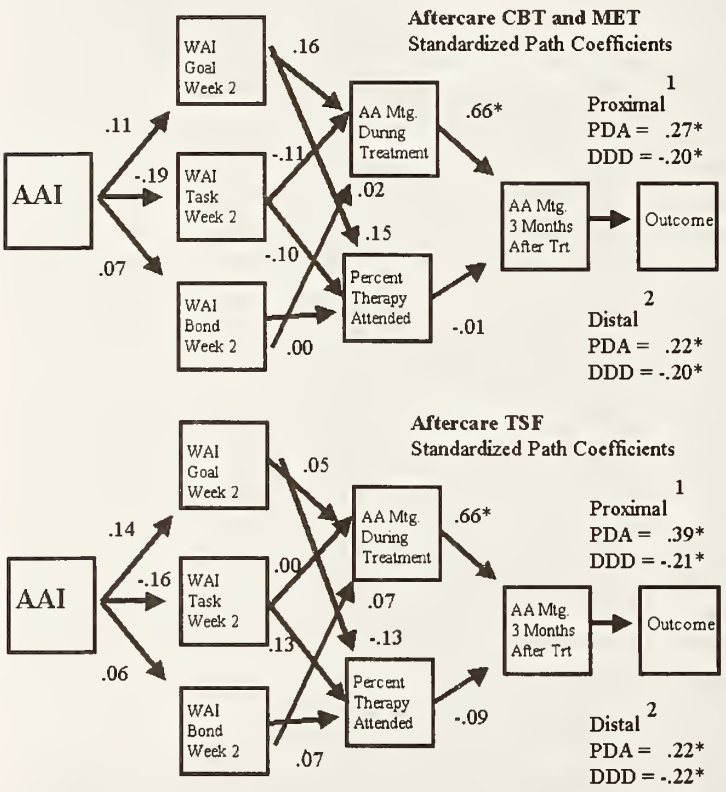

Figure 2: AAI causal model for aftercare TSF and combined CBT and MET conditions

[1]Proximal outcome defined as months 4–9 (first 6 months after end of treatment).

[2]Distal outcome defined as months 10–15 (second 6 months after end of treatment).

Outpatient Sample

Prognostic Effects

Among outpatients, no support was found for a prognostic main effect of the AAI on posttreatment outcome. Considering the frequency-of-drinking measure (PDA), there was no overall main prognostic effect (p<.23). Possible variation by quadratic time (p<.09) and the interaction of quadratic time with sites (p<.02) suggested complex relationships associated with site-specific factors. Inspection of bivariate relationships by site indicated a positive and significant relationship (r=0.16) between prior AA and PDA (months 1–6) at one site while this relationship was not present at the other outpatient sites. For the drinking intensity measure (DDD), prior AA involvement was unrelated to posttreatment drinking (p<.48), with little evidence that site or time factors confounded the relationship of interest (all p values >.05).

Matching Hypothesis

Table 2 presents the probability values associated with HLM tests of the prospective AAI matching hypothesis.

None of the overall tests of the AAI matching hypothesis reached Bonferroni-protected statistical significance on either PDA or DDD during or after formal treatment. During the 12 weeks of treatment, there was a trend in the linear time effect in the predicted direction using the frequency of drinking measure (PDA, $p<.08$) such that prior AA engagement and PDA were positively related for clients assigned to TSF while prior AA and PDA were unrelated in the combined CBT and MET conditions. After treatment, a linear time trend was found on the drinking intensity measure (DDD, $p<.09$) such that clients assigned to the combined CBT and MET conditions drank more heavily with greater extent of prior AA exposure, while no relationship was present between prior AA and drinking intensity for TSF clients.

Unplanned pairwise matching contrasts indicated that prior AA involvement moderated treatment outcome in the context of contrasting CBT with MET. Post hoc analyses showed that PDA and prior AA were positively related both during and after treatment for clients assigned to the MET condition. Oppositely, prior AA was modestly and negatively related with PDA during treatment, and prior AA was positively related with DDD during treatment for CBT clients. These overall matching effects were unplanned and hence should be interpreted cautiously. Nevertheless, several of these overall MET versus CBT matching contrasts exceeded Bonferroni-corrected probability values used to test a priori contrasts. Future work should examine the potential moderating effects of prior AA when outpatient treatments paralleling CBT and MET are offered and evaluated.

Table 2. Summary of outpatient HLM of Alcoholics Anonymous Inventory tests: Probability values associated with tests during and after treatment

	Predicted match TSF vs MET/ CBT	Unplanned matching contrasts		
		TSF–CBT	TSF–MET	CBT–MET
During treatment				
PDA	.99	.27	.26	**.02**
PDA linear	.08	.18	.09	.69
PDA quadratic	.76	.66	.32	.13
DDD	.70	.15	.45	**.02**
DDD linear	.50	.63	.48	.82
DDD quadratic	.97	.66	.71	.40
After treatment				
PDA	.69	.50	.17	**.03**
PDA linear	.83	.99	.70	.69
PDA quadratic	.12	.47	**.04**	.17
DDD	.53	.16	.76	.08
DDD linear	.09	.11	.16	.87
DDD quadratic	.56	.58	.64	.94

Causal Chain Analyses

The planned matching AAI hypothesis was not supported. Attention was thus directed to determining the reasons for the failure of our hypothesis. Figure 3 shows the proposed causal chain (and standardized path coefficients) for the AAI hypothesis separately for the two groups included in the AAI matching contrast. Parallel to causal chain analyses in the aftercare sample, multiple regression analyses were conducted to determine if corresponding slopes for the two diagrams in figure 3 differed beyond chance fluctuation. Similar to findings in the aftercare sample, the proposed mechanisms producing the matching effect failed at the first causal link of our model: prior AA involvement did not differentially predict a stronger therapeutic alliance in TSF and relatively weaker associations in the combined CBT and MET conditions (smallest obtained p value=.30).

Partial support was found for subsequent proposed mechanisms in the AAI causal chain in the outpatient sample. In particular, client agreement with therapeutic tasks was positively predictive of AA meeting attendance during treatment and therapy attendance in TSF. These relationships were either nonexistent or negative in the combined CBT and MET conditions (slope contrasts all $p<.01$). Further, it was predicted that during treatment AA attendance would predict posttreatment AA attendance which, in turn, would predict more frequent abstinent days and fewer drinks per drinking day. This prediction was supported in *both* TSF and the combined CBT and MET conditions such that AA attendance for the first 3 months after treatment predicted positive outcomes on both

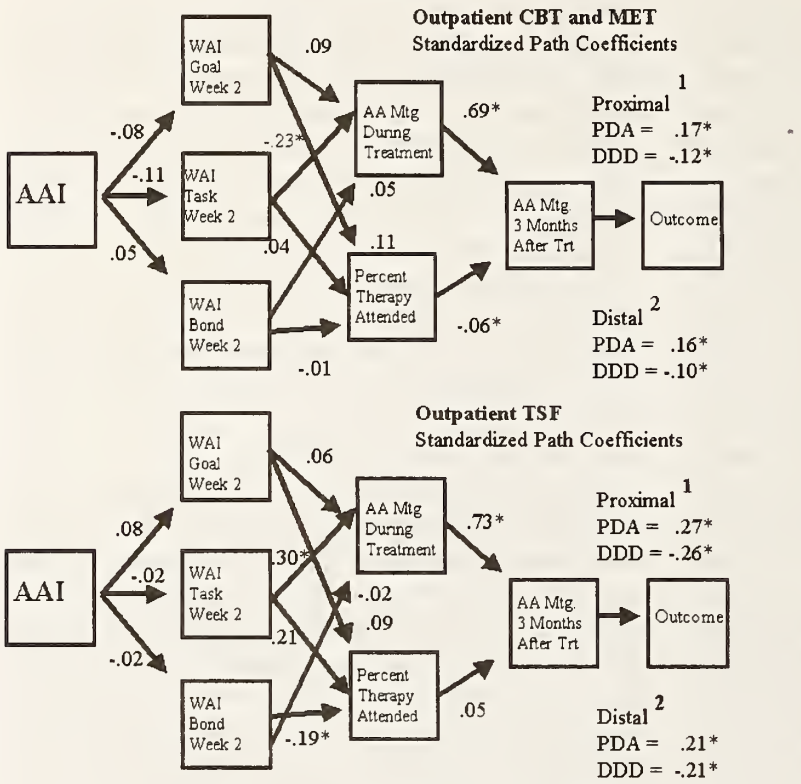

Figure 3: AAI causal model for outpatient TSF and combined CBT and MET condition

[1]Proximal outcome defined as months 4–9 (first 6 months after end of treatment).

[2]Distal outcome defined as months 10–15 (second 6 months after end of treatment).

primary dependent measures at proximal and distal followup periods.

Not specified in the causal model, prior involvement in AA was a significant and positive predictor of AA attendance of outpatients during treatment ($p<.001$), but the magnitude of this effect differed significantly between TSF and the combined CBT and MET groups. Once again contrary to our prediction, the positive relationship was stronger in the CBT and MET combined conditions.

Discussion

In sum, the prospective AAI matching hypothesis was not supported in either the aftercare or outpatient samples. In both samples, the predicted causal chain was weakest at the initial link of the causal model where prior AA was expected to be more closely related to the therapeutic alliance in TSF than in CBT and MET. Consistent with expectations, therapeutic alliances (task compatibility) among the outpatient clients were more positively associated with subsequent AA attendance and treatment compliance in the Twelve Step Facilitation condition than in CBT and MET. Yet this did not translate into differentially better outcomes. The expected prognostic effect of prior AA involvement appeared, if anywhere, in the two treatment groups not based on AA principles.

Prior AA involvement was differentially predictive of treatment response during treatment on both PDA and DDD (p's$<.02$) and, to a lesser extent, on both PDA ($p<.03$) and DDD ($p<.08$) during followup when contrasting CBT and MET, a contrast *not* specified in the AAI matching hypothesis. Exact reasons for prior AA engagement benefiting clients assigned to MET while not benefiting CBT clients are unclear. Certainly, this finding awaits prospective testing and possible replication.

We posited that prior AA involvement would prepare clients, through familiarity, for better outcomes in TSF. It could also be predicted plausibly that greater prior AA involvement would be associated with poorer outcomes in TSF, in that it represents "more of the same" for clients who in one sense could be considered AA failures. Neither assertion was supported by project MATCH findings, suggesting that a 12-step approach is neither indicated nor contraindicated by virtue of prior engagement with AA. The efficacy of the next round of treatment—be it with TSF, CBT, or MET—seems simply unrelated to the extent of clients' previous experience with AA. In contrast, involvement with AA during treatment modestly predicted better outcomes in all three treatment conditions.

Practical Implications

What practical implications can be drawn from the prospective matching findings? First, clients who have had greater AA exposure prior to presenting for treatment (and might be considered, in this sense, AA "failures") fare at least as well in treatment approaches that are not focused on AA principles. Said another way, higher prior AA involvement does not contraindicate or undermine the efficacy of cognitive-behavioral or motivational-enhancement approaches nor does it predict a better response to 12-step-oriented treatment. Although a Twelve Step Facilitation treatment may be initially more familiar and comfortable, this does not translate into differentially more (or less) favorable outcomes. This is reminiscent of the finding that although alcoholics may feel more bonded to and understood by a therapist who is in recovery, recovering therapists are neither more nor less effective than other therapists when it comes to treatment outcome (McLellan et al. 1988; Project MATCH Research Group 1997).

Second, the effect of AA involvement may vary depending upon the outcome measure used. We found that outpatients with greater prior AA exposure tended, after treatment, to consume somewhat more when drinking. Marlatt has cautioned against an abstinence violation effect inherent in the popular AA slogan, "One drink, one drunk," such that once an alcoholic slips there is no expectation of restraint. In another multisite study, we found that pretreatment endorsement of beliefs consistent with a disease model of alcoholism was predictive of a higher risk of relapse through a year of followup (Miller et al. 1996). Brandsma and his colleagues (1980) similarly found that offenders sentenced to attend AA meetings were more likely to show binge drinking during followup, relative to those assigned to cognitive-behavioral treatment. It is noteworthy, however, that the magnitude of such effects is generally small and might be compensated by higher rates of abstinence with a 12-step approach (Project MATCH Research Group 1997).

Third, different measures of AA engagement are not always linearly related. We found, for example, that AA involvement reached a peak around three meetings per week and did not increase further (even decreasing in some contexts) at higher levels of attendance.

Finally, the relationship between AA involvement and treatment outcome is complex. Across aftercare sites in this study, different sites showed positive, negative, or no relationship between outcomes and prior AA exposure. Montgomery and associates (1995) found that whereas AA attendance did not predict treatment outcome, there was a significant relationship between better outcomes and a higher level of actively "working the steps" of AA as reported on their General AA Tools of Recovery (GAATOR) scale. The AA involvement scale used in this study represents yet another way of conceptualizing AA engagement. It appears that the prognostic value of AA engagement depends heavily on how it is measured and may also vary substantially across different contexts.

Acknowledgments

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Social Functioning

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ABSTRACT

It was hypothesized that social functioning would be matched to Cognitive-Behavioral Coping Skills Therapy (CBT) versus Twelve Step Facilitation (TSF) and Motivational Enhancement Therapy (MET) such that clients with lower levels of social functioning would have incrementally better drinking outcomes when treated in CBT relative to TSF or MET. Results in the aftercare arm of treatment failed to support this hypothesis. In the outpatient arm of the study, the matching effect was opposite that hypothesized, that is, the lower the clients' level of social functioning, the worse their drinking outcomes in CBT relative to TSF and MET. Causal chain analyses were conducted to identify where the theory underlying the treatment broke down. Clients who reported greater drink refusal skills after treatment also reported drinking less often and less intensely on days in which they drank. However, CBT failed to increase coping skills of poorly functioning clients more than did MET or TSF. This suggests a failure in CBT implementation, or alternatively, that the other treatments also produced this change. The fact that poorly functioning clients did best in TSF suggests that this treatment has active ingredients, yet to be identified, that are especially helpful to these clients.

Social functioning has been found to be a fairly consistent prognostic indicator among clients treated for alcohol problems in that those with higher social functioning prior to treatment are more likely to have good treatment outcomes. Early reviews supported this relationship (e.g., Gibbs and Flanagan 1977). Subsequent individual studies have continued to support this finding (e.g., Miller et al. 1996). In the absence of treatment-matching effects, social functioning can be expected more often than not to be a variable prognostic of better drinking outcomes.

The challenge then becomes the development of interventions that can reduce the adverse prognostic effects of poor social functioning. If treatments can be devised that eliminate the disadvantage of poor social functioning, the average outcomes of such clients will be enhanced, thus increasing the overall effectiveness of alcohol treatments.

Cognitive-Behavioral Therapy

Social skills training was adapted to treat alcoholics (Monti et al. 1989). This precursor of cognitive-behavioral therapy (CBT) had two points of origin. In Australia, Oei and Jackson (1980) developed a general social skills training program for alcoholics. These investigators assumed that alcoholics had general social skills deficits and because of these used alcohol as an alternative behavior. The hypothesis was that the learning of skills to reduce these social deficits would reduce alcohol consumption.

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At the same time, Chaney and associates (1978) developed a treatment program that focused on teaching social skills for coping with situations in which the alcoholic was at risk to drink. The rationale for this approach was derived from the work of Marlatt (1978; Marlatt and Gordon 1985), who found that relapsing alcoholics identified certain situations that were highly likely precipitants of relapse to drinking. The social skills training program developed by Chaney et al. (1978) taught relapse prevention skills to be used in these situations.

These early studies demonstrated clinical effectiveness for these two variations of skills training. In the following 20 years, social skills training programs have mushroomed and have been modified to incorporate cognitive as well as behavioral coping skills. A body of clinical research has demonstrated that cognitive behavioral therapy is an effective treatment for alcohol dependence (Miller, Brown et al. 1995).

The question that arises from these studies is whether CBT is especially effective for clients with deficits in social coping skills. Client-treatment matching studies have been conducted to test this hypothesis. Kadden and colleagues (1992) found support for this hypothesized matching effect: clients treated in group-administered CBT who were rated as having less skill in a drink refusal role play situation prior to CBT were more likely to be abstinent at the end of treatment than were clients treated in a Yalom-based interactional group therapy.

Of interest, clients high in drink refusal skills prior to treatment did less well in CBT than when treated in the Yalom-based interactional group therapy. The implication from this study is that those who have deficits in relapse-related social skills will especially benefit from CBT, while those without such deficits may be mismatched to a CBT treatment that focuses primarily on these deficits. However, a study carried out by Rohsenow and associates (1991) failed to demonstrate the anticipated matching effect for clients with greater social skills deficits prior to treatment with social skills training versus mood management. Thus, it is not clear under what set of circumstances CBT will be matched to social skills deficits.

As implemented in Project MATCH, based on the work of Monti and associates (1989), CBT involved a menu of skills training modules from which to select. However, all clients were required to receive a core set of eight modules developed to teach skills for dealing with situations in which risk for relapse is normatively reported as high, as these core skills are believed to be most critical (Kadden et al. 1992; Monti et al. 1990, 1993; Rohsenow et al. 1991). Modules developed for dealing with more general skill deficits were optional.

As the modal CBT MATCH client attended about eight sessions, the core sessions were the only set of modules received by the average CBT client. From this information, it would be inferred that the CBT client most apt to be matched to this treatment would be one who had coping skill deficits in these high relapse situations, rather than clients who were generally deficient in social skills, because the average CBT client would not be exposed to these general skill deficit sessions.

Twelve Step Facilitation

Twelve Step Facilitation (TSF; Nowinski et al. 1992) is very much a socially focused treatment. A proximally successful outcome for TSF gets the client involved in AA. However, we assume that sustained participation in AA involves having sufficient social skills to be accepted within the AA Fellowship. The Fellowship is likely to have greater tolerance for deficient social skills, relative to a client's larger social network ("your problems are attributable to your disease of alcoholism, not to the fact that you're a bad person"). Nevertheless, if treatment success is predicated upon acceptance in AA, clients with social skills deficits would be less likely to succeed in TSF than in a therapy such as CBT that totally relies upon the sessions with the therapist, a person trained to have tolerance for, and able to effectively deal with, such clients. As the CBT therapy is assumed to be a sufficient active ingredient for change, its success is not expected to be contingent upon acceptance by AA.

This line of reasoning led us to expect that clients with poorer social functioning would do

worse in TSF than would clients with better social functioning.

Motivational Enhancement Therapy

Motivational Enhancement Therapy (MET; Miller et al. 1992) is intended to activate clients to use their own preexisting resources. The therapy neither provides the opportunity for training social skills to those with such deficits (as does CBT) nor does it focus especially on promoting the client's involvement in a support system that might reject the person because of social deficits (as would TSF). We would expect that the outcomes of MET clients would be consistent with the general prognosis for alcohol treatment-seeking clients. The better their social functioning prior to treatment, the better their drinking outcomes.

Matching Hypotheses

Given these considerations, we hypothesized the following matching effects:

- *The lower the social functioning of the client, the greater the incremental effect of being treated in CBT versus TSF or MET.*
- *The greater the social functioning of the client, the greater the incremental effect of being treated in TSF or MET versus CBT.*

Figure 1 portrays the anticipated effects. Overall, the greater the clients' social functioning, the better their drinking outcome. Assignment to CBT, however, will reverse this effect, such that those with poorer social functioning will have better drinking outcomes in CBT than those with better social functioning. This effect is hypothesized because of our assumption that CBT will be especially effective for clients with greater deficits in social functioning but will be irrelevant for clients who already had good social functioning prior to treatment.

The causal chain postulated to underlie these matching effects is that clients with poorer social functioning prior to treatment will incrementally improve in this domain when

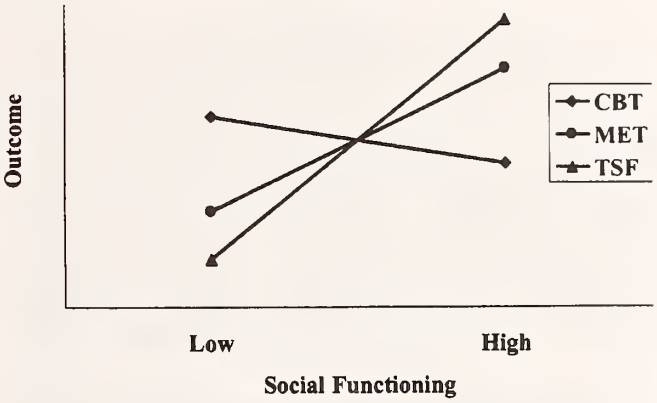

Figure 1. Hypothesized effects of matching social functioning to treatment

treated with CBT skills training. This pretreatment to posttreatment improvement in social functioning will be predictive of reduced drinking. Thus, when the effect of before to after improvement in social functioning is partialed out of the hypothesized interaction effect, this improvement will be shown to be the variable mediating this effect.

Clients assigned to TSF who are unable to sustain participation in AA because of their poor social skills will do as poorly as will MET clients with low social functioning.

Measurement of Social Functioning

Measurement of social skills deficits and functioning was not a high priority for the MATCH study. The development of matching hypotheses such as the present one followed after the selection of the assessment battery. This necessitated a post hoc review and selection from the assessment battery already in place. Two instruments were judged, in combination, to yield an adequate assessment of social functioning.

Social Behavior Scale

The Psychosocial Functioning Inventory (PFI) was developed to provide a brief but comprehensive measurement of clients' self-reported functioning and well-being (Feragne et al. 1983). One scale from this battery is self-reported social behavior, which involves 10

questions, each having 4-point scales measuring the relative frequency (almost daily, at least once a week, less than once a week, not at all) of potentially problematic social behaviors within the prior month (table 1). The items are aggregated to provide a single social-behavior score. This variable has been used in prior studies of psychiatric (Longabaugh et al. 1983*a*) and alcoholic populations (Cooney et al. 1991; Kadden et al. 1989; Fink et al. 1985; Longabaugh et al. 1983*b*; McCrady et al. 1986), where social behavior was found to significantly improve from before to after treatment. However, it has not been sensitive to matching effects (Cooney et al. 1991; Kadden et al. 1989).

Table 1. Items that comprised the Psychological Functioning Inventory

IN THE PAST MONTH	Almost daily	At least once a week	Less than once a week	Not at all
1. Did you avoid talking with family members or friends?	1	2	3	4
2. Did you have to rely on others to make your decisions for you?	1	2	3	4
3. Did your family or friends upset you?	1	2	3	4
4. Did you have heated arguments with other people?	1	2	3	4
5. How often were you upset, angry, or disappointed with the way people did things?	1	2	3	4
6. Did you feel your family or friends did not trust you?	1	2	3	4
7. Did you feel anxious or afraid when you were with other people?	1	2	3	4
8. Did you demand that others do things your way?	1	2	3	4
9. Did you do things that upset you family and friends?	1	2	3	4
10. Did you do things when you were in public that other people did not like? (belching, spitting, wearing inappropriate clothing, etc.)	1	2	3	4

Negative Consequences of Drinking

The Drinkers Inventory of Negative Consequences (DrInC) was developed by Miller, Tonigan, and Longabaugh (1995) to measure negative consequences that the client attributed to drinking alcohol. One of the five subscales of this self-report inventory measures the negative interpersonal consequences the client attributes to alcohol consumption. This 10-item scale is summed to yield an overall score of negative interpersonal consequences attributable to alcohol (table 2).

All clients were administered the DrInC prior to treatment initiation and reported on lifetime negative consequences they attributed to alcohol. Posttreatment, they were administered an alternate form which asked them to report on negative consequences experienced during the prior 3 months.

In order to equally weight both poor social functioning in general as well as poor social functioning that the client attributed to alcohol consumption, both the PFI and the DrInC scales were converted into indices that varied between 0 and 1 and then were averaged to yield an overall index that varied from 0 to 1, with higher scores indicating higher social functioning.

A contrast of outpatient and aftercare clients on this composite measure of social functioning indicated that, as might be expected, outpatients averaged a higher level of social functioning prior to treatment (M=0.51, SD=0.17) than did aftercare clients (M=0.44, SD=

0.17), $p<.001$. Within arms, there were no between-treatment differences in social functioning prior to treatment assignment.

Table 2. Drinker Inventory of Consequences

Instructions: Here are a number of events that drinkers sometimes experience. Read each one carefully and circle the number that indicates whether this has EVER happened to you (0 = No, 1 = Yes). If an item does not apply to you, circle zero (0).

Has this EVER happened to you? Circle one answer for each item.	No	Yes
1. My family or friends have worried or complained about my drinking.	0	1
2. My ability to be a good parent has been harmed by my drinking.	0	1
3. While drinking, I have said or done embarrassing things.	0	1
4. While drinking, I have said harsh or cruel things to someone.	0	1
5. My marriage or love relationship has been harmed by my drinking.	0	1
6. My family has been hurt by my drinking.	0	1
7. A friendship or close relationship has been damaged by my drinking.	0	1
8. My drinking has damaged my social life, popularity or reputation.	0	1
9. I have lost a marriage or a close love relationship because of my drinking.	0	1
10. I have lost a friend because of my drinking.	0	1

Source: Miller, Tonigan, and Longabaugh 1995

Results

Outpatient Arm

Tables 3 and 4 report the results of the overall testing of the matching hypothesis during the within-treatment and posttreatment periods. There were no in-treatment matching effects for either dependent variable, percentage of days abstinent (PDA) or drinks per drinking day (DDD). Within treatment, the overall F for PDA=0.95 and for DDD, F=0.88, both $p>.05$. Interpretation of these statistics is facilitated by figures 2 and 3, which present plots of the expected mean PDA and DDD for clients dichotomized into high (75th percentile) and low (25th percentile) social functioning groups over the entire 15-month period, including the 3 months during which treatment was delivered.

However, during the posttreatment period, strong interaction effects were observed for both PDA and DDD. Those low in social functioning did most poorly relative to those high in social functioning when treated in CBT. This relationship between social functioning and drinking was less pronounced in MET and was reversed in TSF, where low functioning clients had better

Table 3. Hierarchical linear modeling results for within-treatment drinking in the outpatient arm for social functioning

		MV × Tx		MV × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	t	1.16	-1.32	0.20	-0.02	0.06	-0.11
	p	.25	.19	.84	.98	.95	.91
CBT–TSF	t	1.25	-0.73	0.18	-0.95	0.42	0.88
	p	.21	.47	.86	.34	.67	.38
MET–TSF	t	0.09	0.62	-0.03	-0.96	0.37	1.01
	p	.93	.54	.96	.34	.71	.31
Overall effect	F	0.95	0.88	0.02	0.61	0.11	0.61
	p	.39	.42	.98	.54	.90	.54

NOTE: MV=matching variable, Social Functioning; Tx=treatment; T=linear time; T^2=quadratic time. F tests were used for the overall effect, and t tests were used for pairwise treatment contrasts. Reported p values are based on nondirectional tests (i.e., two tailed).

Table 4. Hierarchical linear modeling results for posttreatment drinking in the outpatient arm for social functioning

		MV × Tx		MV × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	*t*	2.19	-2.24	-0.06	0.84	-0.44	-0.82
	p	.03	.04	.95	.40	.66	.41
CBT–TSF	*t*	3.24	-3.20	-0.79	0.90	0.60	-0.56
	p	.002	.002	.43	.37	.51	.57
MET–TSF	*t*	1.08	-1.00	-0.74	0.05	1.13	0.27
	p	.28	.32	.46	.96	.26	.79
Overall effect	*F*	5.40	5.33	0.40	0.50	0.64	0.35
	p	.005	.005	.67	.61	.53	.70

NOTE: MV=matching variable, Social Functioning; Tx=treatment; T=linear time; T^2=quadratic time. *F* tests were used for the overall effect, and *t* tests were used for pairwise treatment contrasts. Reported *p* values are based on nondirectional tests (i.e., two tailed).

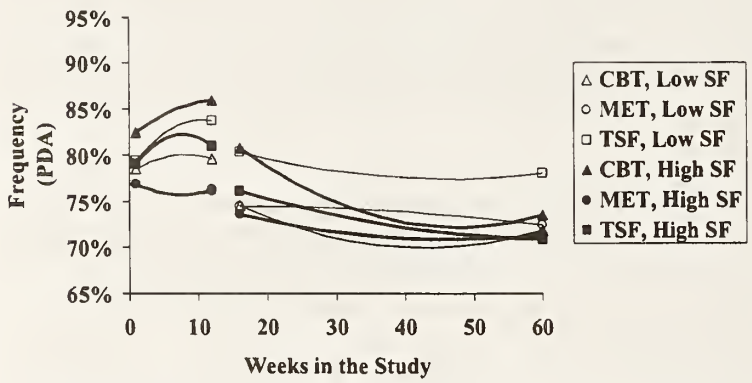

Figure 2. Percentage of days abstinent as a function of treatment modality and social functioning: Outpatient arm

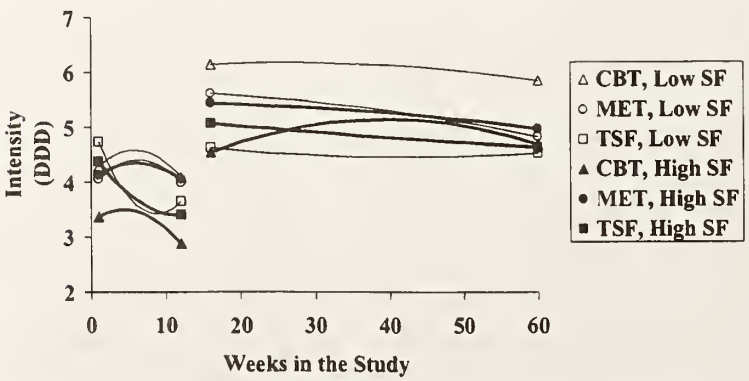

Figure 3. Drinks per drinking day as a function of treatment modality and social functioning: Outpatient arm

outcomes than those with high social functioning.

Further, as TSF clients with low functioning entered the posttreatment followup period, they started with a higher percentage of days abstinent than comparable MET and CBT clients, and they preserved this level of abstinence throughout the followup period. In contrast, both CBT and MET low functioning clients began and ended followup with a lower percentage of days abstinent. However, even MET low functioning clients had more abstinent days than comparable CBT clients for most of the followup period. For high functioning clients, CBT appeared to have a nonsignificant initial advantage during the treatment period, which lasted into the beginning weeks of the posttreatment phase but then rapidly diminished, so that by the end of followup, PDA was no different for this group than the other high functioning groups.

A comparable posttreatment interaction effect was present for the measure of drinking intensity. However, in this instance, the low functioning CBT clients were drinking significantly more drinks on a drinking day than high functioning clients in CBT and more than both high and low functioning clients in TSF and MET.

In summary, in the outpatient arm of the study, an unexpected matching effect was observed. Lower levels of social functioning were associated with particularly poor drinking outcomes for clients treated in CBT and particularly good outcomes for comparable clients treated in TSF. CBT clients with high social functioning had better drinking outcomes than those with a lower level of social functioning.

Aftercare Arm

In the aftercare arm, there was no strong evidence for an interaction effect that was independent of time, either in the direction predicted or opposite the direction predicted. During treatment, as is apparent in table 5, there was no suggestion of interaction effects. During

Table 5. Hierarchical linear modeling results for within-treatment drinking in the aftercare arm for social functioning

		MV × Tx		MV × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	*t*	-0.41	1.46	-0.35	-0.50	1.26	-0.11
	p	.68	.14	.73	.62	.21	.91
CBT–TSF	*t*	-0.09	0.86	-1.34	0.71	1.52	-0.90
	p	.93	.39	.18	.48	.13	.37
MET–TSF	*t*	0.32	-0.57	-0.99	1.19	0.29	-0.79
	p	.75	.57	.32	.23	.78	.43
Overall effect	*F*	0.09	1.08	0.95	0.71	1.34	0.47
	p	.91	.34	.39	.49	.26	.62

NOTE: MV=matching variable, Social Functioning; Tx=treatment; T=linear time; T^2=quadratic time. *F* tests were used for the overall effect, and *t* tests were used for pairwise treatment contrasts. Reported *p* values are based on nondirectional tests (i.e., two tailed).

Table 6. Hierarchical linear modeling results for posttreatment drinking in the aftercare arm for social functioning

		MV × Tx		MV × Tx × T		MV × Tx × T^2	
		PDA	DDD	PDA	DDD	PDA	DDD
CBT–MET	*t*	0.63	0.24	1.21	0.18	-0.63	-0.50
	p	.53	.81	.23	.86	.53	.62
CBT–TSF	*t*	-1.21	1.19	2.72	-1.45	-2.22	1.52
	p	.22	.23	**.01**	.15	**.03**	.13
MET–TSF	*t*	-1.81	0.95	1.53	-1.62	-1.59	2.00
	p	.07	.34	.12	.10	.11	**.05**
Overall effect	*F*	1.69	0.79	3.72	1.57	2.59	2.16
	p	.19	.46	**.02**	.21	.08	.12

NOTE: MV=matching variable, Social Functioning; Tx=treatment; T=linear time; T^2=quadratic time. *F* tests were used for the overall effect, and *t* tests were used for pairwise treatment contrasts. Reported *p* values are based on nondirectional tests (i.e., two tailed).

the posttreatment period (table 6), the CBT–TSF contrast in slopes changed over time for PDA (p=.01) but not for DDD (p=.15). The percentage of days abstinent by high social functioning CBT clients remained high during the followup period, while those with low social functioning initially did well but then deteriorated, so that they were doing worse than the high functioning CBT clients for most of the followup (see figure 4).

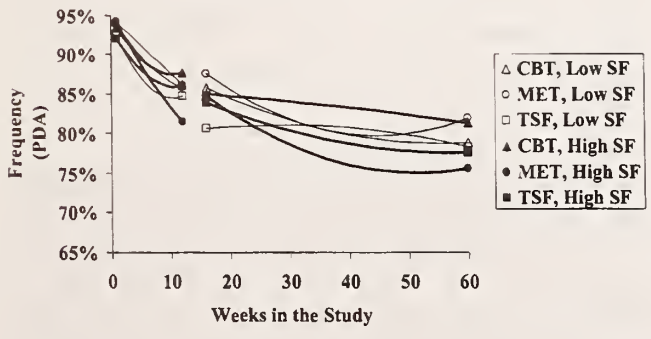

Figure 4. Percentage of days abstinent as a function of treatment modality and social functioning: Aftercare arm

Causal Chain Analyses

The A Priori Causal Chain

Our a priori matching hypothesis was that poor social functioning clients would have better drinking outcomes when treated in CBT, while those with high functioning would do poorly when treated in CBT. This hypothesis was predicated on the assumption that those with poor social functioning would benefit from the social skills training provided for high relapse situations in CBT. For those already having high social functioning, we assumed that such skills training would be superfluous, thus the focus of CBT treatment would be misguided.

Evidence to support this causal chain would be provided if it were found that CBT improved the social functioning of low functioning clients more than did either TSF or MET and that improved social functioning was associated with better drinking outcomes. If both of these conditions were true, then further analysis would be conducted to see whether the improved social functioning accounted for the hypothesized

CBT versus TSF by social functioning matching effect. However, the hypothesized matching effect was not observed.

To test the first part of the purported causal chain, a general linear models procedure was used to analyze the relationship between treatment assignment and social functioning immediately following treatment after controlling for social functioning at baseline, by arm. For both arms, the relationship was found to be nonsignificant.

To test the second part of the purported causal chain, a general linear models procedure was used to separately analyze drinking at each of three points in time as a function of social functioning at that time, controlling for baseline drinking and baseline social functioning scores, by arm. Three posttreatment observation points were used: end of treatment (3 months), 6 months after treatment completion (9 months), and 1 year after treatment completion (15 months). These data points were selected because they were the three in which posttreatment overall social functioning scores could be computed (data points at which both the DrInC and the PFI social behavior scale were administered). In every case (3-, 9-, and 15-month data points), posttreatment social functioning was strongly associated with posttreatment drinking (p's all $<.0001$) after controlling for baseline drinking and baseline social functioning in both the outpatient and aftercare arms

In summary, causal chain analysis revealed where the chain broke down. While the relationship between posttreatment social functioning and PDA was supported, the relationship between treatment assignment and posttreatment functioning was not.

Discussion

The results in the outpatient arm were opposite those hypothesized. The effect appears to be quite robust and unlikely to have been produced by chance alone. Causal chain analyses indicated where the initial theory broke down—CBT was not more effective than the other two treatments in increasing social functioning. So even though those who reported better social functioning had better drinking outcomes, CBT clients were not disproportionately represented in this group. Thus, CBT's failure to incrementally improve the drinking outcomes of clients with poor interpersonal skills is accounted for.

What is not accounted for is why low functioning clients should do significantly worse with CBT than with the other treatments, especially TSF. The theory underlying CBT is that alcohol clients lack coping skills, leading them to use drinking as a dysfunctional coping mechanism. Learning adaptive coping skills, taught in CBT, should address the problem. Why should clients with poor social functioning skills do worse than when treated with TSF or even MET?

One speculation offered to account for this poor showing is that, contrary to theory, to be helped by cognitive behavioral skills training, clients may need to have a modicum of skills already available in their repertoire in order to make use of further training. For those not having the prerequisite starting skills, the costs involved in learning and utilizing them may preclude practice, acquisition, mastery, or generalization of these behaviors to real (as opposed to role play) situations. Certainly, Project MATCH CBT did not include any provision for determining whether clients were actually using the skills that they rehearsed in therapy.

The nonenduring tendency for CBT clients with high social functioning to be doing better than their counterparts during the treatment phase and immediately following is consistent with this conception that those who are likely to benefit from CBT are those who already have good enough skills to make further acquisition easier. However, the dissipation of the initial gain suggests that use of these skills may have been discontinued not long after the end of therapy.

Future Research Directions

One question for further research is why clients with poor social functioning did best in TSF. One speculation that might be researched is that the involvement in AA that was a goal of TSF might have been of special help to clients with especially poor interpersonal functioning. As stated earlier, AA views the person's

dysfunctional lifestyle as being attributable to the disease of alcoholism. Thus, poor interpersonal functioning may be attributed to factors believed to be outside of the person's voluntary control, which only a long period of sobriety and working the 12 steps of AA can rectify. In such a circumstance, there may be a very broad tolerance for deviance among other AA members. The availability of unconditional regard, as long as the AA member seeks to stop drinking, may provide the opportunity for a person to regain the self-esteem that might otherwise not be forthcoming from the client's own social network. An increase in self-respect in turn might provide the client with the hope and motivation to remain sober and begin to deal with the negative consequences of alcohol consumption.

A priority for future investigation with these data is a causal chain analysis to identify the process that leads these TSF low functioning clients to fare better than would otherwise be predicted

Conclusion

Results from the outpatient arm of the study contradict the a priori hypothesis that CBT will be especially effective in improving the drinking outcomes of clients with the poorest interpersonal functioning. Causal chain analysis identifies the source of failure for CBT—such clients do not utilize coping skills more than do comparable clients in other treatments. However, unexplained is why such clients do best in TSF treatment.

Acknowledgments

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Part VII: Conclusions and Implications

Methodological Assessment and Critique

Substantive Review and Critique

Methodological Assessment and Critique

Philip W. Wirtz, Ph.D., and Richard Longabaugh, Ed.D.

ABSTRACT

The preceding chapters have as a common goal the identification of what went right and what went wrong in the theories leading to the matching hypotheses. The authors of these chapters took a number of distinctly different approaches in meeting this common goal, with varying levels of success. In the present chapter, we review some of these alternative approaches with an eye toward identifying the strengths and weaknesses of each. In the process, we address some of the difficulties inherent in the shift from testing the mediation of main effects to testing the mediation of moderator (or interaction) effects (as is a primary objective in matching studies). We consider in this chapter the manner in which some of these difficulties can be overcome and some of the challenges introduced in the causal testing of latent growth models. We conclude with prescriptive guidance which we hope will inform the field as it continues the fruitful pursuit of causal chain analysis.

Testing Causal Chains

The procedure for testing mediation has been formalized by Baron and Kenny (1986) and further explicated by Holmbeck (1997). The procedure is based upon empirical tests of four simple conditions. Following these guidelines, in order to conclude that variable B mediates the relationship between variables A (independent) and C (dependent; see figure 1), four conditions must prevail: (1) A and C must be related in the hypothesized direction, (2) A and B must be related in the hypothesized direction, (3) B must be related to C (in the hypothesized direction) after controlling for A, and (4) the relationship between A and C must be smaller after controlling for B than it is before controlling for B. In practice, the first three conditions require the relationship between the two variables to be directionally statistically significant at some preordained level of α (conventionally, 0.05). Condition 4 is satisfied if the parameter estimate obtained by regressing C on A (controlling for B) is smaller than the parameter estimates obtained by regressing C on A without controlling for B.

Note that the Baron and Kenny formulation is just as important for models in which mediation is hypothesized and is *not* found as it is for models in which mediation is hypothesized and *is* found, because strict adherence to the four steps provides an indication of where the purported causal chain broke down if the hypothesized mediation cannot be empirically verified. Relying on figure 1 again for example, if A is found not to be significantly related to B (and/or if C is found not to be significantly related to B after controlling for A), it provides an immediate indication of the locus of a logical flaw in the hypothesized causal chain. Thus, Baron and

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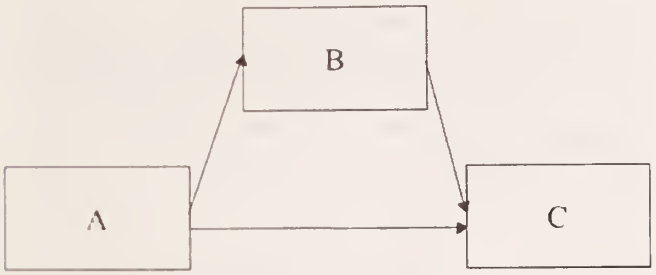

Figure 1. Model of a mediated effect, where B is a purported mediator of the relationship between A and C.

Kenny (1987) and Holmbeck (1997) understate the value of the four-step procedure to the process of causal chain analysis: in addition to providing a rigorous test of whether mediation occurs, these four steps also provide an indication of where the purported model failed when hypothesized mediation is found *not* to occur.

One implication of this four-step procedure is that relationships which might appear to be mediational are not. Consider the case where we know a priori that some factor A is a strong causal factor for C, and it does so through only one mechanism, which is to induce variation in B, with A being the sole cause of B. For example, suppose that there was an exact dose response between amount of smoking in a 6-month period (A) and buildup of plaque on arteries (B). Second, let's assume that there is a strong dose response between the thickness of the plaque in the arteries and resting blood pressure (C), although this is not the only cause of C. Suppose this leads to a correlation between A and B of 1, between B and C of 0.5, and between A and C of 0.5. If we calculate the semipartial correlation of B and C, controlling for A, it will be zero. Initially, this might seem to be an example where full causal mediation is in place, but condition 3 does not hold, because B is not related to C after controlling for A.

The problem here is that the standard that was set in answer to the question of "what constitutes mediation?" is lower than that required by Baron and Kenny. Under this example, Baron and Kenny would insist that before B (plaque buildup in the arteries) is called a mediator, it is necessary to establish that it is a causal factor of C (high blood pressure). When A is the sole causal antecedent of B (as in this example), then while it *might* be the case that B (plaque) is a causal factor of C (high blood pressure), it might alternatively be the case that *smoking* is the true causal factor and that plaque is just "along for the ride". Essentially, Baron and Kenny require that B be established as a true causal factor of C before it is called a mediator, and this is not possible if A and B are perfectly (or very highly) correlated.

To drive the point to an absurdity, suppose that there is a fourth variable (D) which is highly correlated with both A and B in this example: for instance, suppose that D is "percentage of friends who are smokers". Now, suppose we have measured only A, D, and C, and we wish to know if D mediates the relationship between A and C. If condition 3 was merely bivariate and did not control for A, it would allow us to reach the dubious conclusion that percentage of friends who are smokers mediates the relationship between smoking and blood pressure. (This is a dubious conclusion because it is doubtful that having a greater percentage of friends who smoke *causes* high blood pressure.) By controlling for A, condition 3 would eliminate this variable as a potential mediator, because it has not been proven that percentage of friends who are smokers (D) is *causally* related to high blood pressure. In the same way that D is eliminated as a potential mediator by Holmbeck's condition 3 under this model, B would be eliminated as a potential mediator under the model of the original example—and for the same reason.

The difference here is one of *could be* versus *is* a mediator. In the example, plaque buildup *could be* a mediator but we are not sure it is causally linked to high blood pressure, so we do not call it a mediator under the Baron and Kenny standard. Under Baron and Kenny, a higher standard needs to be met in order to establish mediation: there needs to be evidence of a causal link between the putative mediator and the outcome before mediation can be established.

A potential weakness in this four-step approach lies with its rather cavalier treatment of variables outside the model which could influence the outcome. For example, the under-

pinning of the condition-2 requirement that A and B be related lies with the logical assertion that, in order for B to mediate the relationship between A and C, B has to be *caused* by A. However, merely establishing that A and B are related provides a necessary but totally insufficient empirical test for the causal assertion because it does not account for the possibility that A and B are not causally linked but are rather both consequences of some antecedent variable. Thus, a much stronger test of condition 2 than is found in the typical application of the Baron and Kenny formulation would require A and B to be related *after controlling for other variables which might represent alternative explanations for the existence of the relationship.* Similarly, although it is not frequently cited in applications of the Baron and Kenny formulation, condition 3 would be much stronger if, in addition to controlling for A, additional control variables were added to the model which would refute potential threats to internal validity.

A fully comparable alternative approach for testing mediation employs structural equation modeling. Under this approach, the direct A–C effect is initially estimated by omitting B from the model. Following this, a full model containing both the direct (A–C) and indirect (A–B–C) linkages is tested. Mediation occurs when (1) the A–C effect in the initial model is directionally significant, (2) the A–B and (3) B–C effects in the second model are directionally significant, and (4) the A–C effect in the second model is less than the A–C effect in the first model. These conditions are exactly analogous to the Holmbeck (1997) explication of Baron and Kenny's (1986) formulation.

The choice between these two alternatives is often driven by whether the investigator has multiple indicators for A, B, and/or C. The two approaches are fully equivalent when each of the variables is measured by a single indicator. Multiple indicator models dictate the selection of a structural equation modeling procedure as the analytical procedure of choice.

While these two approaches have been widely adopted for testing simple mediation hypotheses, the formal test of a matching causal chain is one level more sophisticated, in that it requires testing for mediation of a *moderator* (i.e., interaction) effect rather than of the *main* effect that is addressed under the Baron and Kenny formulation and by a structural equation modeling approach. The additional challenge imposed by a matching hypothesis is further heightened under a structural equation modeling approach, where detection of interactions involving latent constructs has proven particularly daunting.

Even under the single-indicator Baron and Kenny formulation, the purported causal path can take any of several different forms. The potential for these different forms imposes a considerably greater burden on the investigator, who must explicate the model to be tested in advance of formally testing any causal chain hypotheses. As described subsequently, the application of the Baron and Kenny formulation for single-indicator models to mediated moderation models is relatively straightforward, given that the investigator has adequately explicated the postulated model in advance.

Some authors in this monograph approached the mediated moderation question by testing each treatment condition separately, similar to the "within-groups" approach critiqued by Finney and associates (1984). Such an approach carries the advantage of being arguably simpler to understand and to execute than following the Baron and Kenny four-step formulation. Unfortunately, however, the use of this approach does not permit either a formal test for the existence of mediation or a reflection of the locus of failure in a failed causal chain. The anger matching hypothesis, for example, is predicated on the presumption that pretreatment anger leads to resistance, and that MET more effectively deals with resistance than does (for example) CBT. One approach for testing such a hypothesis would require the assessment of pretreatment anger and posttreatment resistance. A causal diagram of this hypothesized model is presented in figure 2. While separate testing of an anger →posttreatment resistance link for MET versus CBT clients might reveal a significant relationship among CBT clients and a nonsignificant relationship among MET clients (as hypothesized), the magnitude of the between-treatment *difference* in the strength of the link might be small and nonsignificant—especially in the case

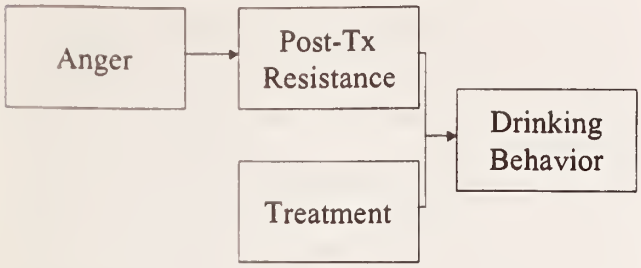

Figure 2. Example of a purported mediated moderator relationship

where CBT reflects marginal significance (i.e., p slightly below α) and MET reflects marginal nonsignificance (i.e., p slightly above α). Furthermore, if separate testing of MET versus CBT clients revealed that *both* groups reflected a significant relationship between anger and posttreatment resistance (as would also be consistent with the theory), there would be no mechanism using this approach for determining whether the anger-resistance link was *significantly* weaker for MET clients than for CBT clients. Thus, separate analysis of the treatments can actually be counterproductive, incorrectly suggesting (in some situations) a mediating effect that does not exist and incorrectly failing to validate the existence of a mediating effect when it does exist.

There is a deceptive attraction of analyzing treatment groups separately for the purposes of determining the locus of causal chain breakdowns. If the results of separate-group analysis fail to reveal a relationship (e.g., between anger and resistance) in a group where it was hypothesized, or if the relationship is found in a group where it was not hypothesized, this would at first glance seem to provide an indication of where the causal chain failed. However, the former case requires the methodologically incorrect practice of accepting the null hypothesis. The "failure to reveal" a relationship (at some preordained level of certainty, as manifested in the investigator-specified type 1 error level) is not the logical equivalent of "determining with certainty that the relationship does not exist." The latter case is also logically flawed: *any* non-zero relationship can be found to be statistically significant if the group size is large enough, and therefore a finding of an unanticipated "significant" relationship may be nothing more than an artifact of sample size. Thus, the practice of separately analyzing treatment groups in order to determine the locus of failures in the hypothesized causal chain is fraught with methodological shortcomings.

How, then, does a researcher who wishes to investigate the loci of a causal chain failure (or to statistically validate a hypothesized causal chain) proceed in the context of a matching (or, more generally, moderator) hypothesis? The answer lies in a *joint* analysis of *all* treatment groups using an extension of the Baron and Kenny formulation. In the anger-resistance example, because anger is hypothesized to lead to resistance, the interaction between *anger* and treatment is hypothesized as a distal reflection of the more proximal interaction between *resistance* and treatment. Phrased more formally, the resistance-treatment interaction is hypothesized to mediate the anger-treatment interaction. This provides a slightly more sophisticated application of the Baron and Kenny formulation, where A in figure 1 represents the anger-treatment interaction, B represents the interaction between resistance and treatment, and C represents drinking behavior (figure 3).

With these simple representations in place, the four-step Baron and Kenny formulation (as elucidated by Holmbeck) can now be applied in

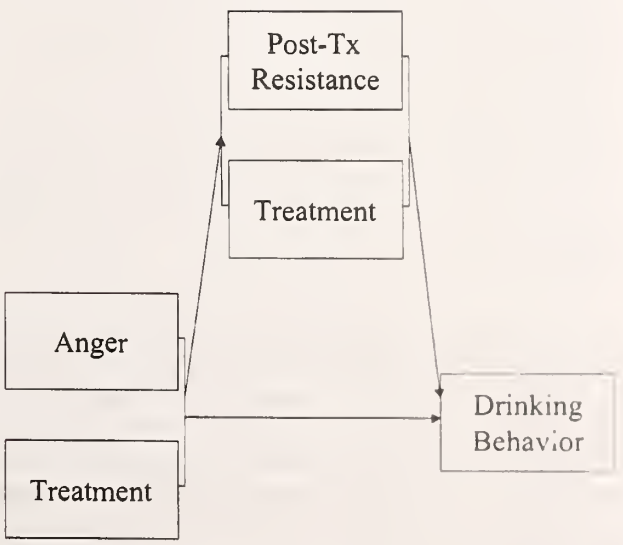

Figure 3. Testing a purported mediated moderator relationship

order to obtain a formal *statistical* test of the hypothesis of mediation. The only challenging part of this formulation lies in step 2 (establishing a relationship between A and B), because B is now an interaction. If the hypothesized interaction involves only two groups, B is a vector composed of the product of the two constituent variables. In this case, step 2 of the Baron and Kenny formulation can be implemented under a standard general linear model. If the hypothesized interaction involves more than two groups, B is an array composed of k - 1 product variables (where k is the number of groups specified in the hypothesis). In this case, step 2 of the Baron and Kenny formulation can be implemented under a standard multivariate general linear model.

We noted earlier that the Baron and Kenny formulation is just as important in determining where a purported mediational model failed as it is in determining the empirical plausibility of a hypothesized mediational model. The quintessential importance of this dual applicability is no less salient in the extension of the Baron and Kenny formulation to the mediation of moderator models than it is to the base applications referenced by Baron and Kenny and by Holmbeck. The simple substitution of interaction terms for A and for B in the Baron and Kenny formulation underscores two critical issues for investigators wishing to employ causal chain analysis. First, it is crucial that the investigator rigorously specify, in advance, the *specific* causal chain(s) that is (are) hypothesized, and then proceed to test *exactly* that chain. Second, in matching (or attribute-by-treatment) models, where the focus is on hypothesizing and testing group differences in the relationship between an attribute and an outcome variable, analyzing the groups separately will lead to a suboptimal (and, in all likelihood, inconclusive) result.

Canonical Models and the Testing of Causal Chains

As described earlier (pp. 21–26), the expansion of the Baron and Kenny (1986) formulation to include the mediation of moderator (interaction) effects carries with it the concomitant expansion of the types of models that can be investigated. Figure 2, for example, represents a model in which the purported matching effect is hypothesized to occur as a result of the surrogation of a matching variable (anger) for a more proximal variable (resistance) which interacts with treatment. Alternatively, the investigator might hypothesize that the treatment leads to a proximal outcome which interacts with the matching variable vis-a-vis drinking behavior. The Typology Hypothesis Team, for example, hypothesized that CBT and TSF would differ from MET in the amount of structure inherent in the treatment modality, and that degree of structure would interact with Typology (Type A vs. Type B) in affecting drinking behavior.

It should be emphasized that the value of distinguishing between canonical models is primarily descriptive. Whereas Canonical Type 1 focuses on a proximal effect of treatment to explain the hypothesized interaction, Canonical Type 2 focuses on a proximal effect of the matching variable. The empirical test of a Canonical Type 1 model, however, continues to follow the four-step Baron and Kenny (1986) formulation. In the case of Typology, for example, A would be replaced by the Typology-Treatment interaction, and B would be replaced by the Typology-Structure interaction (see figure 1).

A third canonical form, which we identify as Canonical Type 3A, is exemplified in the motivational readiness causal chain. Here, the interaction between treatment and readiness to change was hypothesized to affect alcohol abstinence self-efficacy (the putative mediator) which, in turn, was hypothesized to affect drinking outcome. In terms of the Baron and Kenny (1986) formulation, the formal testing of this type of model is slightly simpler than the other two canonical forms we have introduced: A is replaced by the original matching interaction (e.g., treatment-readiness to change), and B is replaced by the putative mediator (e.g., alcohol abstinence self-efficacy).

The fourth canonical form, which we identify as Canonical Type 3B, is tested in the same way as model 3A. What is different is that the content of the putative mediator in 3B is a change in the therapeutic implementation hypothesized to occur as a result of the original matching interaction.

Inherent Difficulties

We have argued above that the formal procedure for testing a putative causal chain involving a matching effect is not, if applied with sufficient rigor, arduously more difficult than the formal procedure for testing the type of mediational model described by Baron and Kenny (1986). However, there are analytical considerations which make the detection of interaction effects considerably more difficult than the detection of main effects.

Although interaction effects are frequently found in experimental studies, they are notoriously more difficult to detect in field settings. A number of reasons for this difficulty have been cited, including the covariance of the interaction term with its component variables, differences in measurement error, the use of nonlinear scales, and differential residual variances of interactions once the component main effects have been partialed out. McClelland and Judd (1993) have shown that tests of interactions in field studies will often have less than 20 percent of the efficiency of optimal experimental tests. Centering the component variables prior to creating a product-term interaction may reduce the problem (see Aiken and West 1991), although the usefulness of this procedure in significantly reducing the problem remains unclear (see Finney et al. 1984). In general, the powerful detection of interaction effects in field settings remains a highly elusive goal, the careful design and large sample size of Project MATCH notwithstanding.

Statistical Considerations

It has been noted with some alarm that the number of Project MATCH a priori hypotheses which were confirmed empirically is substantially less than what would be expected by chance (using a type 1 error rate of 0.05). Does this reflect negatively on our ability to understand the complex relationships involved in treatment matching for alcoholism? The preceding chapters of this monograph would certainly underscore just how complex some of these relationships can be. But it is also possible that statistical issues reduced the power of the study to identify hypothesized matching relationships. Three issues are of particular interest: the nature of the outcome measures, the inability to capitalize on the virtues of a latent growth model, and the possibility of undiscovered site differences. We consider each of these in turn.

The Nature of Outcome Measures.

Alcohol data are notorious in their departure from the assumptions of the general linear model. There are often clusters of "extreme" values (e.g., abstinence), the observations are rarely normally distributed around the regression line, and the relationships may be curvilinear. In contrast, most of the analytical procedures employed in alcohol research require nicely distributed mound-shaped data for which *p* values are reasonably accurate.

In order to bridge the gap between data as we would like them to be and data as they present themselves, it is not uncommon to attempt to induce normality and homoskedasticity through some sort of transformation. For example, a log transformation can often be helpful when the data are severely skewed to the right; a negative log transformation can be employed when the data are severely skewed to the left. Square root transformations are frequently of use when the skew is not quite so severe.

Transforming data presents two principal problems. First, interpreting the transformed data can often be challenging in the absence of obvious theoretical relevance, and therefore the results frequently have to be "back translated" by employing a reverse (or reciprocal) transformation in order to bring the units back into an interpretable metric. This is particularly challenging with alcohol treatment outcome data, where the nature of the skew is likely to change across time. For example, prior to treatment, drinking frequency measures (such as percentage of days abstinent) are likely to be positively skewed, with most individuals reflecting comparatively low values and some outliers reflecting comparatively high values of abstinent days. However, posttreatment (and particularly *immediately* posttreatment), these same measures are likely to be *negatively* skewed, with most individuals reflecting comparatively high values and some outliers reflecting compara-

tively low values. This nonnormality problem then poses a challenge to the researcher: should the same transformation be applied both at baseline and posttreatment (in order to preserve the integrity of the interpretation of the transformed variable), or should different transformations be applied to the same measure taken at different times in order to respond to the requisite assumptions under the general linear model?

In Project MATCH, the former approach was ultimately selected, although the question was thoroughly debated. In the end, employing different transformations on the same variable at different points in time was viewed as indefensible. However, this decision necessarily moved the analysis plan away from the assumptions necessary for the correct interpretation of the *p* values that were critical to the interpretation of the results. Alternative operationalizations of the primary outcome measures were considered (e.g., a dichotomization such as abstinent/nonabstinent or heavy drinking/not-heavy-drinking), but the loss of information in such alternative operationalizations was considered too great to base the entire trial on it.

A second problem associated with transforming the data to conform to the requisite assumptions of the general linear model was that, even after transformation, the data did not conform very well to these assumptions. When you have a large group of heavy drinkers (at the beginning of the trial) or of light drinkers (immediately following the end of treatment), normality cannot be even reasonably approximated in measures such as percentage of days abstinent. Thus, the *p* values on which the trial results were based were predicated on untenable assumptions. The exact effect of these departures from assumptions is unknown, but is likely to have contributed at least somewhat to the inability to detect a large number of "statistically significant" matching effects.

It should also be recognized that the primary intensity outcome measure (drinks per drinking day) possesses a property that limits its interpretability. In order to assign a value to this variable for all subjects in the trial, it was necessary to define a value for this indicator to take on when the individual did not drink at all during the period under study. After considerable debate, the Project MATCH Steering Committee decided to retain this variable as one of the two primary outcome variables and to assign the value zero to anyone whose number of drinking days during the period was zero. Thus, low scores on this variable could indicate either of two things: a truly low intensity or no drinking days at all (and therefore no basis for computing the intensity). The potential multidimensionality associated with this variable may also have been a contributor to the dearth of significant findings. (In fact, fewer matching effects were observed for the drinks per drinking day outcome variable than for the percentage of days abstinent matching variable.)

Latent Growth Modeling

This study presented one of the largest opportunities to introduce the features of latent growth modeling to the domain of randomized clinical trials. Latent growth modeling provides a feature not available in more traditional forms of the general linear model: the ability to remove random between-subject variation from the error term when testing hypotheses about fixed effects (such as the matching hypotheses). The approach is particularly useful when the individuals in a well-defined subgroup (such as those who receive a certain form of treatment modality) follow a similar pattern of increase or decline in drinking behavior across time. When this is the case, removing the between-subject variation from the error term of the *F* test of an a priori contrast can greatly increase the power of the analysis to detect hypothesized relationships.

Unfortunately, the subjects in Project MATCH revealed remarkable heterogeneity in drinking behavior across time, even among subjects who were in identical treatment modalities, identical sites, similar baseline drinking levels, and similar demographic profiles. While a clear-cut overall decrease in drinking was evident across the 12-week treatment period, and a slow regression toward more drinking was evident across the posttreatment followup period, there was little evidence to suggest that well-defined subgroups of individuals followed a similar (and distinguishable) growth trajectory.

After extensive analysis, it became clear that the best theoretically grounded model to fit these data was quadratic (allowing for a curvilinear growth pattern across time), but even under such a model the between-subject heterogeneity was quite high. As a result of this heterogeneity, there was little to commend this approach over the more traditional multivariate analysis of covariance procedure—a fact which was born out in the highly similar results across the two procedures.

Do these results suggest that latent growth analysis (also known as hierarchical linear modeling) has a limited (if any) role in longitudinal studies of drinking behavior? Probably not: the promise of latent growth is still very real. The failure here was likely attributable in large part to the previously noted aberrational distributional characteristics of the primary outcome measures. With measures which provide clearer growth patterns of individual change across time, it is likely that latent growth analysis will prove to be considerably more powerful than the classical multivariate analysis of covariance approach. But with outcome measures as heterogeneous as the Project MATCH primary outcome variables, there is little apparent justification for more sophisticated analytical techniques such as latent growth analysis.

Undiscovered Site Differences

The Project MATCH analysis plan was centered around the assumption of a common model of drinking behavior influences for *all* outpatient subjects (and a distinct common model for *all* aftercare subjects), with site adjustments for baseline and demographic differences. This assumption provided a large pool of subjects (with commensurately large power) for testing the primary matching hypotheses.

The common-model assumption is, however, a double-edged sword: while it provides the basis for powerful detection of hypothesized matching effects, it also opens up the possibility of considerable within-sample heterogeneity. In essence, after minor adjustments for cross-site differences in baseline drinking and demographic characteristics, the assumption views the data as if the subjects were all selected from a *single* source, which they were not.

An extensive analysis provided no indication of systematic cross-site differences which, if not accounted for, would influence the results of the study. Nevertheless, the question remains whether focusing the analysis on individual sites would have reduced the heterogeneity to a sufficient level to overcome the resulting loss in power.

Conclusion

Why the matches believed to be so promising investigated in Project MATCH were not supported remains an uncertainty. Although those hoping for recommendations on robust clinical matching algorithms were disappointed, a great deal of guidance and wisdom regarding the design and analysis of subsequent matching studies has been achieved. A decade ago, when MATCH was conceptualized and implemented, the methodology developed by Baron and Kenny (1986) for testing for mediators was not well understood and had not been disseminated to the alcohol treatment research community. By the time Holmbeck (1997) published his paper clarifying this methodology, MATCH had been completed. Now that mediator analysis has become well known to the field, future studies will benefit from these clarified procedures. The MATCH causal chain analysis, despite its early inception, provides direction to those seeking to undertake mediation analyses of moderator variables.

Five lessons learned from Project MATCH pertain to the conduct of future treatment outcome studies.

First, it is absolutely critical that the investigator be clear not only about *what* is being hypothesized but also about *why* that matching hypothesis is being proposed. Advancement of theory is not well served by being right for the wrong reason.

Second, it is equally important that the research test both the hypothesis itself and the purported causal chain in a statistically defensible manner. As we examined each of the causal chains presented in this monograph, these were the two tenets of causal chain testing protocol that were commonly violated. Even when the hypothesized chain was structurally sound and

well defended, the failure to follow the four steps of the Baron and Kenny formulation (or their equivalents under a structural equation model) often led to a disappointing inability to identify where the chains failed. Although requiring minor modification for nonadditive models, the seminal foundation laid by Baron and Kenny for testing mediational models provides a solid framework for not only determining whether the purported causal model of a matching hypothesis is tenable, but also for identifying the locus of failure in those situations where the hypothesized causal model is not supported.

In our review of the preceding chapters, we found two tenets of the causal chain testing protocol that were frequently violated. The first was the failure to rigorously specify, in advance, the specific causal chain(s) that was (were) hypothesized and then to proceed to test exactly that chain. The second was the failure to follow the four steps of the Baron and Kenny formulation (or their equivalents under a structural equation model), often leading to an inability to identify where the chains failed.

Third, particularly in alcohol research (where the outcome measures often defy requisite distributional assumptions of the analytical technique), the distributional characteristics of the data are important factors in considering the choice of analytical technique. Sophisticated analytical approaches such as latent growth analysis will be of little value in the context of data which do not support the requisite distributional assumptions.

Fourth, the above-mentioned point notwithstanding, the promise of latent growth analysis looms quite large in longitudinal alcohol research where (1) the outcome measures are not characterized by gross skewness and (2)individuals are likely to be characterizable by their unique growth pattern. Project MATCH demonstrated the feasibility of latent growth analysis in a multisite randomized clinical trial.

Fifth, while a larger number of subjects means greater power to detect hypothesized effects, larger is not always synonymous with better—especially when the subjects come from multiple sites. The increased heterogeneity may offset the gains in power. To the extent that a smaller sample accurately reflects the systemic behavior of a smaller definable population of theoretical or practitioner interest, the investigator might be well advised to move in this direction rather than focusing on a larger, multisite, sample.

Some have criticized Project MATCH because it did not support large numbers of matching hypotheses. While this was disappointing to investigators and interested parties alike, we believe that the number of lessons learned from this study have moved the field forward. We do not agree with those who view the negative results from this trial as a widespread reflection of the futility of matching studies. With the lessons learned from this trial in hand, we believe that the future of alcohol matching studies has been considerably strengthened.

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Substantive Review and Critique

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ABSTRACT

The first part of this chapter summarizes all of the client-treatment interactions observed in Project MATCH, irrespective of whether they were hypothesized. For those hypothesized, we examine the extent to which their underlying causal chains were supportive or still remain unknown. For emergent interactions, we evaluate their plausibility as matching hypotheses to be tested in future investigations. We conclude that MATCH detected evidence for several small interaction effects. We then address the lessons learned from the causal chain analyses. In the second part, we examine implications of our findings, first for future matching research and then for alcohol treatment research more generally. We conclude that Project MATCH's investigation of the mediation of matching effects has provided guidance for future alcohol treatment research.

We are now reaching the completion of our journey. The aims of this volume were first to present the rationale for each of the a priori matching hypotheses, the hypotheses themselves, and results. The second aim was to present the theory underlying each of the matching hypotheses and the results of testing these theories by causal chain analysis. For unsuccessful predictions, the causal chain analysis identified how the theory failed. For supported matching predictions, the causal chain analyses tested whether the underlying theoretical assumptions were the mechanisms through which the hypothesized interaction occurred. These analyses and results have now all been reported. The preceding chapter provides a methodological critique of the various approaches taken to testing the causal chains and matching predictions.

In the first part of this chapter, we attempt an integration of the overall effort, incorporating all data from the observed client-treatment interactions and causal chain analyses. Next, we examine the unique contribution of the causal chain analysis to understanding Project MATCH results. In the second part, we offer our recommendations and perspectives on treatment matching specifically and future treatment research more generally.

Summary of Observed Client Attribute-Treatment Modality Interactions

Before undertaking this review, introductory comments are in order. The presentation is organized by arm of study, and within arm of study, by phase of treatment—within treatment followed by posttreatment effects. Within each section, first the a priori hypothesized interactions that were supported are addressed in detail. Here our assumption is that these hypotheses have been supported. Therefore, our focus is in critiquing how well we understand the theory underlying the matching prediction. Next we describe the observed interactions that were not hypothesized. Here our focus is on exploring the plausibility of the interaction. Is it simply a chance occurrence or is it possible that it reflects a true effect? Causal chain analysis is used to

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evaluate the plausibility of the observed interaction. As the probability of finding both an observed interaction and a supporting causal chain by chance alone would be extremely low, this observation would suggest further research may be warranted.

It should be noted that in many instances observed interactions were not involved in an a priori contrast. Consequently, pertinent causal chain analyses were not conducted. In other instances, however, the treatment contrasts were involved in an a priori hypothesis, but the observed outcome was *opposite* that predicted. Here causal chain information is more likely to be available and pertinent.

Finally, given our evaluation in the last chapter that few of the underlying theories for the a priori matching hypotheses were both conceptually explicit and clearly and correctly operationalized, inferences drawn from the causal chain analyses are necessarily speculative. No supporting causal chain analysis was carried through to the last step of ruling out competing interpretations for the observed matching effect. Further, causal chain analyses of failed matching hypotheses were not required to identify all of the linkages in which the causal chain was unsupportive—only one failed link was needed. Thus, complete information necessary to critique each matching hypothesis is not available. Despite these limitations, we believe there is sufficient information from the causal chain analyses to enrich our understanding of the client attribute-treatment interactions tested.

The Observed "Hit Rate"

Considering the large number of interactions tested, it is entirely possible that all of the interactions observed may be attributed to chance. Leaving aside interactions involving time, only 3 percent of the a priori hypothesized contrasts were supported at the Bonferroni level of adjustment. Twelve contrasts met our criteria for significance out of 400 tested (2 dependent variables × 40 hypothesized contrasts, each tested 5 times—aftercare within- and posttreatment and outpatient within- and posttreatment and months 37–39).

This suggests two possibilities. Perhaps all a priori hypotheses are untrue, with those appearing to be supported being attributable to chance alone. Another possibility is that we made our criteria for rejecting the null hypothesis too stringent. The familywide Bonferroni correction may have led us to underdetect valid client-treatment interactions.

In order to provide a context for assessing these alternative interpretations, it is useful to provide the studywide hit rate for tests of interactions. Had we specified a studywide uncorrected alpha level of 0.05, we would expect on average 5 percent of all nonexistent interactions tested to meet our criteria by chance. Overall, across the 2 study arms, 2 dependent variables, 21 matching variables, and 3 treatment contrasts per matching variable (CBT vs. MET, CBT vs. TSF, MET vs. TSF), 504 tests of attribute by treatment modality interactions were conducted (excluding those involved in either a linear or quadratic interaction with time). Of these, 38 were observed to be significant at $p \leq .05$, 7.5 percent of those tested. This hit rate is somewhat greater than that expected by chance alone.

A possible implication of this comparison is that our attempt to capitalize on what we thought we already knew to develop a priori predictions actually impeded our ability to uncover evidence for matching. Had we been less confident of our predictions, we might have conducted an exploratory hypothesis-seeking analysis with one portion of the data and used the other as a holdout sample upon which to test the emergent hypotheses. The Steering Committee considered this alternative but ultimately rejected it because of our (in retrospect unfounded) confidence in the predictions that were developed.

While the MATCH requirement of a priori hypotheses had the great virtue of sharpening the focus of study, it also precluded examination of emergent interactions that had not been predicted. Now that all of the hypotheses have been tested, exploratory investigations of other observed interactions are appropriate. With this perspective in mind, we examined the tables in the separate chapters reporting the results for interactions tested though not hypothesized. We extracted any interaction that met the $p \leq .05$ alpha level and incorporated these results

into appendices 1 and 2. These show all interactions that occurred, whether hypothesized or not, including those involving linear and quadratic time. Appendix 1 summarizes the outpatient arm, appendix 2 the aftercare arm.

As this information, though of potential significance, is too vast to address, table 1 presents for both arms of study only those interactions that did not involve a time dynamic (i.e., an interaction of the matching effect with time). Treatment contrasts involving 14 of the 21 matching variables met the criteria specified. While several of the interactions involving change over time are quite interesting and even comprehensible (i.e., the matching effect increases or decreases over time), we have not yet identified the tools necessary to undertake a causal chain analysis that could explain these dynamics.

Outpatient Arm

Within-Treatment Interactions

No matching prediction was observed during the within-treatment period that met the Bonferroni level of adjustment. Four interactions were observed with p's ≤.05.

Psychopathology and Psychiatric Severity. During treatment, there was evidence supporting an a priori matching hypothesis that CBT would be more effective than MET for more psychologically impaired clients. Not hypothesized but observed, TSF was also more effective than MET for more impaired clients. This suggests either that CBT and TSF each may have a distinct component that is helpful to more impaired participants which MET lacks, or that CBT and TSF may share an active ingredient lacking in MET that may help high psychopathology clients. One obvious active ingredient shared by CBT and TSF was the greater number of treatment sessions available (12 vs. 4). This may have accounted for this beneficial effect during the treatment period (rather than CBT's hypothesized greater focus on psychopathology).

Gender. It had been hypothesized that women would do better in CBT than in TSF, relative to men. In fact, the opposite was observed. Women treated in TSF had more abstinent days during treatment than when treated in CBT. Causal chain analysis revealed that most of the differences related to instrumentality and expressiveness upon which the gender matching hypothesis was predicated were in fact present. Where the causal chain appeared to fail was in CBT's inability to influence these characteristics as expected. Instead, one of the causal chains tested (involving both canonical models 1 and 2 (see pp. 21–26)) showed that females in CBT reduced their psychiatric severity less than did males in CBT, and less than either males or females in TSF. This would suggest that CBT's relative failure to diminish women's psychiatric severity may have accounted for their lesser improvement in drinking while in treatment. This causal chain is not completely supportive of the theory, however, as posttreatment psychiatric severity did not predict days abstinent during treatment for women. Thus, the puzzle remains. It should be noted that several of the hypothesized causal chains were not directly tested, so the mediating mechanism for TSF's superiority for women may yet be detected.

Sociopathy. It was hypothesized that CBT would be more effective than MET for clients high in sociopathy. Instead, during treatment, clients with high sociopathy fared equally well in CBT and MET. However, clients low in sociopathy had a higher percentage of days abstinent (PDA) when treated in CBT than their MET counterparts. This would suggest that CBT is either mismatched to high sociopathy, or MET is mismatched to clients low in sociopathy.

While the well-articulated causal chains did not attempt to account for drinking during treatment, indirect support for the interaction was observed in one of the causal chains conducted to account for posttreatment drinking. This type 3A canonical chain involved the working alliance. CBT clients low on sociopathy were more likely to have a better working alliance, and a better working alliance was related to better PDA. For MET clients, working alliance was unrelated to drinking outcomes. The linkages in the causal chain are thus consistent

Table 1. Observed interactions

Matching variable	Study arm[1]	Observation period[2]	Hypothesized contrast[3]	Observed contrast[4]	Predicted[5]	Dependent variable[6]	Causal chain supportive?[7]
Psychiatric Severity	OPT	Treatment	CBT>MET	CBT>MET	yes*	PDA	no
Gender	OPT	Treatment	CBT>TSF	TSF>CBT	opposite	PDA	no, partially tested
Sociopathy	OPT	Treatment	CBT>MET	MET>CBT	opposite	PDA	yes
Prior AA	OPT	Treatment		MET>CBT	no	PDA, DDD	not tested
Psychiatric Severity	OPT	year 1+	CBT>TSF	CBT>TSF	yes	PDA	no
Anger	OPT	years 1, 3	MET>TSF, CBT	MET>TSF	yes	PDA, DDD	no
				MET>CBT	yes	PDA, DDD	no
Self-Efficacy	OPT	year 1	MET>CBT	CBT>MET	opposite	DDD	yes
Social Functioning	OPT	year 1	CBT>MET	MET>CBT	opposite	PDA, DDD	no
			CBT>TSF	TSF>CBT	opposite	PDA, DDD	no
Prior AA	OPT	year 1		MET>CBT	no	PDA	not tested
Interpersonal Dependency	OPT	year 1		CBT>MET	no	PDA	no
		year 3		CBT>MET	no	DDD	no
		year 3	MET>TSF	TSF>MET	opposite	DDD	no
Network Support	OPT	year 3	TSF>MET	TSF>MET	yes	PDA, DDD	yes
A vs. B Typology	OPT	year 3	MET>TSF	TSF>MET	opposite	DDD	no
			MET>CBT	CBT>MET	opposite	DDD	no
Self-Efficacy	AFT	Treatment	MET>CBT	MET>CBT	yes*	PDA, DDD	no
		Treatment	MET>TSF	MET>TSF	yes	PDA, DDD	no
ASPD	AFT	Treatment	CBT>TSF	CBT>TSF	yes*	DDD	not tested
Temptation	AFT	Treatment		CBT>MET	no	PDA	not tested
Readiness	AFT	Treatment	CBT>MET	MET>CBT	opposite	PDA	no
Readiness	AFT	year 1		TSF>CBT	no	PDA	not tested
Alcohol Dependence	AFT	year 1	TSF>CBT	TSF>CBT	yes	PDA, DDD	yes

1. OPT = outpatient, AFT = aftercare
2. Treatment = months 1–3, year 1 = first year after treatment completion (months 4–15), year 3 = 37–39 months after treatment initiation
3. A priori
4. $p \leq .05$, 2-tailed test
5. yes = difference in slopes same as hypothesized, opposite = observed contrast in slopes opposite what was predicted, no = no a priori contrast hypothesized
6. PDA = percentage of days abstinent, DDD = drinks per drinking day
7. yes = causal chain supports the observed interaction (irrespective of what was hypothesized), no = there is not a complete linkage supporting the observed interaction even though one or more was tested, not tested = a complete linkage of the causal chain to the observed interaction was not tested.

* = hypothesized contrast but significant only when unprotected ($p \leq .05$)

+ = There was both an attribute by treatment interaction and a time by attribute by treatment interaction. The contrast was significant at months 5–11. The finding is included because of the fact of the attribute by treatment interaction.

with the direction of the observed sociopathy-treatment modality interaction. This supports the credibility of the interaction observed despite its variance from the original hypothesis.

Prior AA. No matching effect had been hypothesized for the interaction of prior involvement in Alcoholics Anonymous (AA) and MET versus CBT treatment assignment. However, it was observed that for those with prior AA involvement, MET is predictive of higher PDA and fewer drinks per drinking day (DDD), while for CBT clients, prior AA is predictive of poorer drinking outcomes. As this contrast was not a candidate for causal chain analysis, only speculation can be offered. MET encourages clients to develop their own change plans, which may lead to utilization of AA during and after treatment. In contrast, CBT, with its own prescriptions for client change, may inadvertently work against whatever predilections some clients would have for invoking AA prescriptions for recovery.

Posttreatment Interactions

Psychiatric Severity and Psychopathology. An ordinal interaction effect was hypothesized for psychopathology. It was expected that for low levels of psychopathology, treatment assignment would not make a difference, but as psychopathology increased, clients assigned to CBT would have better drinking outcomes than those assigned to either TSF or MET. An ordinal interaction was observed; however, contrary to expectations, clients with low psychopathology had better drinking outcomes in TSF than in CBT. For those with high psychopathology, CBT was neither better nor worse than TSF.

Despite the unanticipated implication for clinical triaging—assign low psychopathology clients to TSF—the theoretical premise underlying the hypothesized interaction was supported. As CBT client psychopathology increased, drinking outcomes improved. As this was not so for TSF, where clients outcomes were unaffected by their level of psychopathology, it could be concluded that CBT was helping clients with greater psychopathology more than it was helping those with less. However, CBT's increased efficacy for clients with higher psychopathology raised their level of outcome sufficiently only to equal that of comparable TSF clients. This suggests that TSF has one or more active ingredients more helpful to all alcohol clients than does CBT. CBT's increased efficacy for the subset of clients with high psychopathology appears to compensate for the absence of these unidentified active ingredients.

The matching effect observed was no longer significant after the tenth month of posttreatment, suggesting that the differential effect of CBT versus TSF on clients varying in their psychopathology fades over time.

Multiple attempts to identify one or more underlying supportive causal chains for this interaction, both a priori and post hoc, were unsuccessful. These attempts, when decomposed, involved canonical models 1 and 3A. The causal chains indicated that, contrary to what was hypothesized, there was neither greater attention to client psychopathology in CBT nor did CBT clients experience a greater reduction in psychopathology following treatment. The mechanisms by which this interaction is produced are yet to be identified.

Anger. Client anger was observed to interact with MET versus TSF/CBT treatment modalities to produce a disordinal interaction during followup. This matching effect was the most consistent one observed in the entire study. Evidence for the matching effect was present at all followup points—at 3-year followup as well as during the first year of followup. However, the theoretical underpinnings for this effect could not be identified in the causal chain analyses conducted, which involved canonical models type 2 (for taking steps and problem recognition) and type 3 (for working alliance).

Also problematic, the a priori matching hypothesis proposed was ordinal: that angry clients would have better drinking outcomes in MET than in either CBT or TSF. The theory underlying this matching hypothesis was that high anger clients would be more resistant to treatment than would low anger clients. It was expected that MET, with its nonconfrontational stance, would reduce the client's resistance to treatment, and by doing so, produce better drinking outcomes. Unanticipated was that low

anger clients would have poorer drinking outcomes in MET than in CBT/TSF.

Nevertheless, a review of treatment research findings for other psychological dysfunctions indicates that a disordinal matching effect similar to this one has often been observed. If the state-trait anger variable is considered to be an index of reactance (Brehm 1976; Brehm and Brehm 1981), it has been found that psychotherapy clients with high resistance (also an index of reactance) are most effectively treated with a supportive, nonconfrontational, low directive therapy, while those low in reactance (or resistance) are most effectively treated with a more directive therapy (Beutler et al. 2000).

The hypothesis team was at a disadvantage regarding the selection of the putative mediators of this matching prediction. The assessment battery had already been decided upon by the time Secondary Matching Hypothesis Teams had completed development of their causal chains. The Anger Matching Hypothesis Team selected five indices hypothesized to characterize an *absence* of client resistance—two measures from the SOCRATES readiness scale: Problem Recognition and Taking Steps for Change, and three measures from the Working Alliance: Agreement on Treatment Goals, Tasks, and Bonding.

A first problem with these indices was that only one, Working Alliance Goals, was negatively related to client anger as would be expected and necessary for the underlying causal chain to be supportive. The two other indices of working alliance were unrelated to client anger. Problem Recognition was actually significantly related to client anger in the opposite direction predicted. Thus, there was a breakdown in the causal chain in the first linkage.

While the hypothesis team observed that the indices of working alliance partially mediated the relationship of the anger-treatment matching variable to drinking, the analysis conducted included working alliance variables as both main effects and product terms. As the separate effects were not reported, their status as putative mediators of the moderating effect is confounded with their main effects.

As discussed in the preceding chapter, the fact that the relationships were reduced from significant to nonsignificant when these mediators were partialed out might also be attributable to the greater number of degrees of freedom utilized in the mediator analyses.

The one putative mediator of the matching effect that appears to be operative is Problem Recognition, which reduces the relationship of the treatment-anger variable to PDA to nonsignificance and is also related to client anger. However, this relationship is positive rather than negative. This suggests that angry clients are more likely to report problem recognition, which when paired with MET as opposed to CBT and TSF, leads to better PDA.

This causal chain involving problem recognition has migrated considerably from the causal chain from which the hypothesis team started. Waldron et al. (this volume) conclude that the data at hand do not provide an adequate operationalization of Resistance. They expect that tape ratings of therapy sessions may provide such an index in the future. Beutler's research is supportive of this interpretation. He and his colleagues have found that observer ratings of therapist directiveness and client resistance produce the anticipated disordinal matching effect (Beutler et al. 2000; Karno et al. in press). Thus, despite the lack of a supporting causal chain, the disordinal matching effect is highly credible.

Network Support for Drinking. As hypothesized, clients with network support for drinking prior to treatment had better drinking outcomes at 3-year followup than those assigned to MET. Although hypothesized to be ordinal, the interaction actually gave indication of being disordinal, as clients with little support for drinking prior to treatment had significantly (but only slightly) better outcomes in MET than in TSF.

The causal chain model tested was type 1. The analyses indicated that participation in AA was in part responsible for the observed attribute-treatment interaction. Clients treated in TSF were more likely to participate in AA, which in turn was differentially associated with better drinking outcomes, with those high in network support benefiting the most. However, the significance of the matching effect was only

substantially reduced, not eliminated, when the effect of AA participation was partialed out. So other mediators, as yet unidentified, also contribute to this attribute-treatment interaction.

Another point of interest here is that the mediator variable itself turned out to be a moderator variable, the product term of network support for drinking and AA participation and treatment modality. The enhanced benefit of AA participation for clients with networks supportive of drinking was most apparent in TSF. This suggests that the compatibility of treatment modality and self-help group belief system is likely to be an important factor to consider in matching. Research by McCrady and colleagues (1999) bolsters this speculation. These investigators found that a cognitive-behavioral Alcohol Behavior Couples Therapy followed by AA involvement was less helpful than a cognitive-behavioral relapse prevention aftercare model.

Finally, two other aspects of this attribute-treatment modality interaction have yet to be satisfactorily accounted for. First, why did clients with networks unsupportive of drinking actually do somewhat better in MET than in TSF? No explanation or analysis was offered to account for this tail of the disordinal interaction. Second, it is not clear why the interaction that eventually emerged for TSF's superiority with clients having networks supportive of drinking did not do so earlier in the followup period. Presumptively, participation in AA after treatment completion explains the delayed matching effect, but this has not been tested.

Nonpredicted Outpatient Interactions

Nonhypothesized interactions involving five matching variables were observed during the posttreatment period: Prior AA, Self-Efficacy, Social Functioning, Interpersonal Dependence, and Typology.

Prior AA. The effects of prior AA involvement in the MET and CBT treatment contrast observed during treatment continued into the first year of posttreatment. MET clients who had been involved in AA prior to MATCH treatment continued to have more abstinent days than those not so involved, while for CBT clients, the reverse was observed. The pervasiveness of this interaction into the posttreatment period strongly suggests that further study is warranted.

Self-Efficacy. It was hypothesized that self-efficacy would interact with treatment modality such that clients low in self-efficacy would do better in CBT than in MET. In the outpatient arm (in contrast to the aftercare arm), an interaction occurred that suggested the opposite. Low self-efficacy clients treated in MET had fewer drinks per drinking day than those treated in CBT.

The causal chain analysis supported this finding. Employing a canonical model 3A, an interaction effect involving change in self-efficacy in CBT versus MET was tested. It was found that low self-efficacy MET clients had a greater increase in self-efficacy before to after treatment than did CBT clients. This increase in self-efficacy predicted end of treatment drinking which in turn predicted self-efficacy at 9 months and drinks per drinking day in the year following treatment. Thus, the causal chain analysis, by supporting the observed interaction, strengthens the credibility of this finding, despite its opposition to what had been hypothesized.

Social Functioning. It was hypothesized that CBT would be more effective than either TSF or MET for clients who had poor social functioning. In fact, the opposite effect was observed. Clients with poor social functioning who were assigned to CBT had fewer abstinent days and more drinks per drinking day throughout the first year of followup. Clients with high social functioning initially did better in CBT, but this superiority dissipated as the year went on.

The causal chain analysis was limited to determining where the a priori theory had broken down. While it was found that, as expected, posttreatment social functioning predicted posttreatment drinking, CBT did not improve social functioning more than did MET or TSF. This explained why CBT was not superior to MET and TSF for poorly functioning clients. However, it does not explain why it should be significantly worse. Post hoc causal chain analyses are necessary to explore this finding.

Interpersonal Dependency. No a priori predictions were made regarding contrasting effects of CBT and MET on clients varying in their interpersonal dependency. Nevertheless, interactions were observed for PDA in the year following treatment and for DDD at the 3-year mark. During the year following treatment, MET clients with higher dependency had fewer days abstinent than those with low dependency. At 3 years out, higher dependency in CBT was associated with fewer drinks per drinking day. Thus, in one case, high-intensity treatment was beneficial to more dependent clients, and in the other, low intensity treatment was beneficial to those with low dependency.

At 3 years, as had been hypothesized, TSF was associated with fewer drinks per drinking day for more highly dependent clients. Combined with the results for CBT, this suggests that interpersonal dependency is predictive of fewer drinks per drinking day in higher intensity treatments, but unrelated to DDD in low intensity treatments. The causal chain analyses, involving treatment completion and treatment satisfaction in a canonical model 3A do not provide any clues for these observed differences. Interpersonal dependency is unrelated to both treatment completion and satisfaction in all three treatments.

A Versus B Typology. It was predicted that clients having a type A typology would have better drinking outcomes in CBT and TSF than in MET, while the reverse would be true for type B clients. At 3-year followup, the opposite effect was reported. Three causal chains were tested. The first tested amount of therapeutic structure and cognitive change in a canonical model 1. The second and third were type 3A canonical models and tested working alliance and change in psychopathology as potential mediators. The models indicated various links in which the causal chains broke down but did not provide any clues as to why the unpredicted interactions occurred. Given the gap in time between treatment and 3-year followup and the absence of a connecting causal chain, it is likely that this finding is spurious.

Summary of Outpatient Arm

During the within-treatment period, none of the a priori predictions was supported at a protected level of confidence. Therefore, nothing definitive can be said about matching clients to treatment modalities during outpatient treatment. If all observed interactions are taken into account, a multidimensional typology would be necessary to develop useful hypotheses about which clients would do better and worse in these treatments. For example, it might be hypothesized that for women, those who are high in psychopathology would do best in TSF and less well in CBT. For men high in psychopathology and low in sociopathy, CBT might be optimal, while MET could be contraindicated.

In the posttreatment period of observation, 13 attribute-treatment interactions were observed. Four of these were predicted, involving psychiatric severity, anger (in two treatment comparisons), and network support for drinking. Six, involving four matching variables—self-efficacy, social functioning, interpersonal dependency, and typology—were opposite the a priori predictions. Three others emerged in the absence of any predictions. One interaction involving prior AA that emerged during treatment persisted through the first year of followup. Two other interactions, involving anger and interpersonal dependency, persisted from the first year of posttreatment followup through to the third.

Whether the criterion be a priori predictions or observed interactions, evidence is sufficient for posttreatment matching effects in the outpatient arm of study.

Aftercare

Within-Treatment

Self-Efficacy. The self-efficacy matching hypothesis was strongly supported in the aftercare arm during treatment. As the effect disappeared after treatment had been completed, the practical advantage to be gained for clinical purposes is diminished. Nevertheless, it has theoretical significance.

It was hypothesized that MET would be more effective than either CBT or TSF for clients with higher self-efficacy. However, with lower self-efficacy, it was predicted that CBT and TSF would be more effective. Results indicated that client

self-efficacy made a difference in MET, such that the lower the client's abstinence self-efficacy, the poorer the drinking outcomes. In contrast, client self-efficacy did not appear to affect treatment success in either CBT or TSF. The net result of these effects was that low self-efficacy MET clients did more poorly during treatment than their counterparts in CBT and TSF. At higher levels of self-efficacy, treatment modality did not differentiate drinking patterns during treatment.

The causal chain underlying the hypothesis anticipated that treatment modality and pretreatment self-efficacy would interact to affect self-efficacy during treatment (canonical model 3A). This differential change in self-efficacy would in turn interact with pretreatment self-efficacy to influence drinking. The causal chain failed in that CBT increased the self-efficacy of all clients more than did MET, thus failing to account for the matching effect.

Nonpredicted Within-Treatment Interactions

In addition to the predicted interaction involving self-efficacy and treatment modality, three other client variables were observed to interact with treatment modality: motivational readiness, antisocial personality disorder (ASPD), and temptation minus confidence.

Antisocial Personality Disorder. It was hypothesized that CBT would be more effective than TSF in treating clients with ASPD. For drinks per drinking day, this contrast was significant at $p<.024$ (a value larger than what was required to meet the Bonferroni correction). As causal chain analyses were conducted only with the related variable, sociopathy, no pertinent information is available to evaluate this attribute-treatment modality interaction.

Temptation Minus Confidence. The construct of temptation minus confidence (closely related to self-efficacy, which did show the hypothesized interaction during treatment) was involved in an interaction contrasting CBT and MET during treatment. Highly tempted CBT clients had more abstinent days than did their MET counterparts. As this contrast was not involved in an a priori hypothesis, no causal chain was developed or tested for this effect.

Motivational Readiness. Motivational readiness was hypothesized to interact with CBT and MET because clients with low readiness were expected to respond to MET more than to CBT. It was expected that highly motivated clients would respond equally well to the two treatments. Thus, an ordinal interaction was hypothesized. The interaction observed was opposite that predicted. Clients with low motivational readiness apparently achieved higher PDA when treated in CBT versus MET. For those with high motivation, treatment assignment made less of a difference. Causal chain analyses failed to support the observed interaction, reducing its credibility.

Posttreatment Interactions

During the 1-year posttreatment period, one hypothesized interaction was observed, involving alcohol dependence. A second, involving motivational readiness, emerged in the absence of a prediction.

Alcohol Dependence. A hypothesized disordinal matching effect was observed. The higher the clients' alcohol dependence, the more likely they would achieve a higher percentage of abstinent days and fewer drinks per drinking day when treated in TSF versus CBT. Conversely, those with lower alcohol dependence would achieve more PDA and fewer DDD when treated in CBT versus TSF. This disordinal interaction met all criteria for matching— clients high on dependence had significantly better drinking outcomes when treated with TSF, while those low on dependence had significantly better drinking outcomes when treated with CBT.

Two causal mechanisms were hypothesized to be responsible for this interaction—therapist emphasis on abstinence and client participation in AA. In both cases, the canonical causal chain model tested was type 1. Only therapist emphasis on AA was supported. Lack of therapist emphasis on abstinence, associated with CBT, was

found to explain the superiority of CBT for clients with low alcohol dependence. As alcohol dependence increased, the superiority of CBT diminished, so that at high levels of dependence, the treatments were not distinguishable in their effectiveness.

Left unexplained by this mediator analysis is why TSF clients with high dependence had better drinking outcomes than comparable CBT clients. It would be expected that as dependence increases, therapist emphasis on abstinence would enhance drinking outcomes. From figure 5 in the Cooney and Babor chapter, it can be seen that this was not the case. While lack of emphasis on abstinence enhanced PDA for those less dependent, emphasis on abstinence did not enhance outcomes for those more dependent. The implication is that some other active ingredient, associated with TSF, was responsible for increasing the PDA of highly dependent clients. This ingredient is yet to be identified.

Nonpredicted Posttreatment Interactions

Motivational Readiness. During the year following treatment, MET and TSF were observed to interact with motivational readiness. No hypothesis had been offered for this contrast. Clients with low motivation treated in TSF had fewer drinking days than those treated in MET. As motivation increased, the treatment differences in PDA decreased. As this did not pertain to a hypothesized contrast, no pertinent causal chain analyses were conducted. It is of interest to note, however, that in both the within-treatment contrast with CBT and the posttreatment contrast with TSF, clients with *low* motivation who were treated in MET had more drinking days. This is inconsistent with the notion that MET is helpful because it increases the motivation of less motivated clients.

Summary of Aftercare Arm

Five interactions were observed during the aftercare treatment. Three were predicted a priori (although only one achieved a protected level of significance), one was opposite that predicted, and one was observed in the absence of a prediction. Within-treatment matching effects occur as often in aftercare treatment as in standalone outpatient treatment. Of note, however, of the aftercare interactions observed, four of the five involved variables as much reflective of state as trait (i.e., readiness, self-efficacy, and temptation minus confidence). It is plausible that client states would be more responsive to ongoing aftercare treatment than would traits.

In contrast, only two matching effects following aftercare treatment were observed. It may be that the confounding of more intensive treatment with the MATCH aftercare treatment diluted posttreatment matching effects that otherwise might have occurred had MATCH been a standalone treatment.

Commentary

In summary, this review of observed client attribute-treatment modality interactions calls attention to several that had not been previously addressed because either:

- Although they were hypothesized a priori, they did not achieve a familywide protected level of significance using a Bonferroni adjustment.
- They were not hypothesized a priori.
- The results observed were in the direction opposite that hypothesized.

Review of all 21 matching variable candidates points to 7 that were not involved in an interaction affecting drinking outcomes (excluding interactions involving a time dynamic): alcohol involvement, psychiatric comorbidity, cognitive impairment, conceptual level, meaning seeking, religiosity, and problem recognition. However, some of these variables had prognostic value, unaffected by treatment assignment: alcohol involvement, meaning seeking, religiosity, and problem recognition (see appendix 3). In such instances, it can be concluded that their prognostic effect was not moderated by this set of treatment modalities, posing a challenge to those trying to develop more effective treatments.

Only two client variables, conceptual level and cognitive impairment, appear to be irrelevant for prognostic or treatment assignment

purposes. Thus, it would appear that all of the variables included in Project MATCH's selection as candidates for matching are, in at least some very small degree, likely to be pertinent to assessing the effectiveness of treatment.

Implications of Matching Results

Having completed our review of all attribute-treatment interactions not involving a time dynamic (i.e., an interaction with time), what implications can be drawn for the idea of matching clients to treatments? Does client-treatment matching affect drinking outcomes? If so, is it possible to conduct treatment outcome research that will demonstrate these matching benefits?

Does Client-Treatment Matching Occur?

Does client-treatment matching occur? Intuitively, the answer is yes. At the most general level, clients treated for one disorder who in fact have a different disorder are less likely to respond to the treatment. Confining our scope to clients treated for alcohol problems, there is evidence that treatment service matching to client profile affects outcomes (e.g., McLellan et al. 1983). The scope of MATCH, however, was more narrowly focused. Our aim was to compare three individually delivered, manual guided and structured psychosocial therapies in their capacity to be matched or mismatched to 21 client attributes, mostly traits and a few states.

Within this limited scope, what do we conclude about matching in Project MATCH? Having reviewed all of our matching results, either there is little evidence for matching at this level of specificity or there is ample evidence for multiple small matching effects.

Argument for No Evidence for Matching

The results observed in Project MATCH may indicate that client attribute-treatment interactions do not occur in a way that would affect client drinking behaviors in a predictable way. We failed to find more than 3 percent of the hypothesized interactions significant at the protected level. Moreover, those that were significant accounted for small portions of the variance. No interaction was significant at all periods of observation nor was any hypothesized interaction significant in both arms of the trial. There is no indication in these data that strong matching effects exist, indicating that the matching paradigm may have outlived its heuristic value.

Argument for Multiple Small Matching Effects

An alternative conclusion is that MATCH results suggest the presence of several small matching effects between single client attributes and these three treatment modalities. As the number of observed interactions may exceed what could be attributed to chance alone, it is likely that something is going on, but we have not been able to comprehend what that something is.

Our inclination is to accept this interpretation of multiple small matching effects. But then, why was this pattern of multiple small interactions observed rather than several strong matching effects? One explanation may lie in the design. Three treatments developed for all patients with alcohol dependence or abuse were compared with one another for their matching effects on clients contrasted in 21 different ways. As each of these client characteristics was believed to be involved in one or more credible matching hypothesis, in effect this meant that they were competing with one another for the same outcome variance.

As only three treatment contrasts were possible, TSF versus CBT, TSF versus MET, and MET versus CBT, on average seven matching variables were involved in each of these contrasts. Given their a priori plausibility, how likely is it that any one matching variable would show a strong matching effect if the others were also influential? If the matching variables were moderately correlated with one another (as most were), it is conceivable that they may have been proxies for one another or for more general underlying constructs.

Under these conditions we might expect to see the pattern observed: small matching effects involving alternative matching variables in different interactions observed during different

periods of observation and in different arms. When it is noted (as we discuss later) that many of the matching predictions relied upon the same putative mediator variables to explain the matching effect, this explanation becomes more likely.

Finally, some matching hypotheses assumed main effects of treatment modality or client matching variable on mediating mechanisms (canonical models 1 and 2, respectively), while others assumed and found these same mediating mechanisms being affected by modality-matching variable interactions (models 3A and 3B). The latter effects would undermine the assumptions of the former. If one matching hypothesis assumes treatment modality has a consistent effect on treatment process, whereas results from testing the causal chain of another matching hypothesis shows the treatment process to be affected by the second matching variable, the conditions necessary for mediation of the first matching prediction may be precluded.

This said, it is nevertheless clear that if matching research is to be productive at this level of specificity, a major shift in approach is necessary. MATCH represented the best effort that could be put forth using this type of approach where single client characteristics were expected to interact with two or more treatments to affect drinking outcomes.

Causal Chain Analyses

A comprehensive review and critique of the causal chain analyses is clearly beyond the scope of this chapter. Instead, we limit our comments to a few of the more salient points to emerge.

First, Project MATCH's use of causal chain analysis increased our understanding of why hypothesized interactions emerged, as in the case of alcohol dependence and network support for drinking. As importantly, the causal chain analysis threw into question assumptions we had as to why other observed matching effects that were hypothesized did in fact occur: anger, psychiatric severity, self-efficacy.

The causal chain analyses also helped to clarify our understanding of why so many of the hypothesized interactions failed to emerge. Causal chain analyses also provided plausibility for a few observed interactions that were not hypothesized.

Finally, prior to undertaking this review, we suggested that it was possible for a causal chain to emerge in the absence of an interaction. This too, in fact, appears to have occurred. For example, in both arms of the study, the amount of structure in therapy interacted with sociopathy to affect drinks per drinking day, and in the outpatient arm, TSF was found to have more structure than MET. Thus the causal linkage appears to be complete, despite the fact that TSF versus MET did not affect drinks per drinking day when clients high and low in sociopathy were contrasted. (The analytic approach used to test these causal chains precluded a test of the significance of the interaction between the two treatment groups. Thus, this inference is tentative).

The most serious limitation apparent from our critique of the causal chain analysis was that all too often the underlying theory was either not made sufficiently explicit so that it could be operationally tested, or if conceptually clear, its operationalization was either not totally accurate or was incomplete. It is now apparent that mediator analysis of moderating effects is a significant challenge. Nevertheless, once beyond these front-end limitations, the causal chain analyses conducted yielded considerable information.

Mediator Variables

The variables hypothesized to act as mediators turned out to be a surprisingly small set of indicators of the treatment process and a somewhat larger number of client responses to treatment.

Treatment Processes

Only six constructs characterizing treatment were tested as hypothesized mediators. Working alliance, amount of structure in treatment, the amount of treatment offered or received, and AA involvement and/or attendance were each tested in the causal chains for several of the hypotheses. Two indices of treatment content were each used once, treatment emphasis on psychopathology and emphasis on abstinence.

Working Alliance. Working alliance was the most frequently tested measure of treatment process. The factors thought to affect it varied across matching hypotheses. And, in fact, analyses indicated that it was affected by treatment modality *and* client matching variable *and* the interaction of treatment modality and client matching variable. For example, in the outpatient arm, MET enhanced clients' experience of the working alliance more than did CBT or TSF in one causal chain analysis, while in another, TSF clients reported better working alliance indicators than did CBT or MET clients.

Such inconsistencies become understandable when the evidence indicates that working alliance is also influenced by the interaction of treatment modalities and some matching variables (cognitive impairment, religious beliefs and background, meaning seeking, and problem recognition). Finally, working alliance is also affected directly by client matching variables (sociopathy, anger, motivational readiness). Given these complexities, it is clear that a matching effect predicated upon working alliance being solely an effect of but one of these three sources of variance is inherently weakened.

While it was expected that motivational readiness, prior AA, typology, anger, and problem recognition each would interact with treatment modality to affect working alliance, this turned out to be so only for problem recognition, which interacted with MET versus CBT/TSF in both the outpatient and aftercare arms.

There was evidence that working alliance was directly affected by client matching variables more often in the outpatient treatments (sociopathy, anger, and readiness) than in aftercare (readiness). Finally, working alliance was observed to be directly affected by treatment modality in both outpatient and aftercare treatments. For example, MET led to a better working alliance than TSF or CBT, and TSF appeared to lead to better agreement on the task of therapy than did either CBT or MET.

Working alliance was also conceptualized as having an effect on drinking outcome. In the outpatient arm, working alliance did indeed have a main effect on drinking outcome. However, its effect was also observed to be moderated by treatment modality (CBT vs. MET) and client matching variable (motivational readiness and typology). In the aftercare arm, working alliance did not have a main effect on drinking outcome but did interact with treatment modality (CBT vs. MET) and matching variable (motivational readiness) to affect drinking outcomes.

Readily apparent from these results, working alliance is influenced by treatment modality and matching variables in multiple ways and in turn affects drinking outcomes either directly or in combination with treatment modality or matching variables.

Treatment Structure. Structure, also invoked as a mediator to explain matching predictions, proved to be less of a discriminator between treatment modalities than expected. For the most part, MET proved not to be less structured than either CBT or TSF.

In the outpatient arm, structure was not affected by treatment modality. In the aftercare arm, structure was reported to be affected by the interaction of treatment modality (MET vs. TSF and CBT) and client typology (A vs. B). This finding indicates that, contrary to our best intentions, the delivery of treatment modality was influenced by client characteristics in the aftercare arm (canonical model type 3B). It appears that type B clients influenced MET to become more structured than when delivered to type A clients.

When structure is viewed as a factor affecting drinking outcome, it appears that in some instances it directly affects drinking (PDA in outpatient), while it may also interact with sociopathy to influence drinking outcome (DDD in outpatient, PDA in aftercare).

AA Attendance. As a final example of the complex ways in which putative mediators are both influenced by client matching variables, treatment modalities, and their interactions and in turn influence drinking outcomes, we cite AA attendance. In the outpatient arm, AA attendance was influenced by treatment modality (TSF vs. CBT, MET), client matching variable (alcohol dependence and network support for drinking), and the interaction of treatment modalities and client matching variables (TSF vs.

MET and/or CBT with network support, religiosity, meaning seeking, and alcohol dependence).

AA attendance, in turn, had both a direct effect on drinking outcome and a moderating effect in combination with TSF versus MET and/or CBT. In the aftercare arm, AA attendance was affected by treatment modality (TSF vs. MET and CBT), client attribute (gender and alcohol dependence), and the interaction of treatment modality with client attribute (TSF vs. MET and CBT with meaning seeking). AA in turn sometimes affected drinking outcome but in other analyses did not do so.

In aggregate, these examples indicate that the putative active ingredients of treatment are themselves influenced by multiple and complex factors and in turn influence drinking outcomes in variable and complex ways. Given this level of complexity, it is not surprising that matching predictions based upon simplifications of these complex dynamics would not be supported.

Client Response to Treatment

In contrast to causal chains involving treatment processes, those involving client response to treatment present a simpler picture. It was generally expected that improvement in the matching variable from before to after treatment would be predictive of better drinking outcomes. In fact, this usually turned out to be the case. Increased self-efficacy, readiness to change, and taking steps to change generally were predictive of better drinking outcomes, as was decreased temptation to drink. Anger reduction, a decrease in network support for drinking, increased social functioning, and a reduction in psychiatric symptoms were also predictive of better drinking outcomes

Nevertheless, when the effect of the interaction of improvement in the matching variable and baseline level of the matching variable was tested, it was found that the effect of the posttreatment score on drinking outcomes could be moderated by the client's baseline score. For example, while anger reduction was predictive of decreased drinks per drinking day in the outpatient arm, the effect of anger reduction on PDA was moderated by the client's baseline level of anger. In the outpatient arm, anger reduction's effect on both PDA and DDD was moderated by the client's baseline level of sociopathy. Thus, causal chains that did not incorporate the interaction of the baseline level of the matching variable into the affect of the posttreatment level on drinking would be more likely to fail.

If, for example, it is theorized that clients with networks supportive of drinking will benefit from a treatment that decreases their network's support of drinking, then it would be expected that those who had networks most supportive of drinking prior to treatment would benefit the most from this intervention. If baseline level of network support is not included as part of the interaction term for predicting drinking outcome, then the causal chain is simply predicting that those who have networks less supportive of drinking will have better drinking outcomes. The logic is, however, that those with networks supportive of drinking would be more affected by a change in network support from pretreatment to posttreatment.

While posttreatment response was usually predictive of drinking outcomes, the predictors of posttreatment response remain a mystery. Neither the matching variable itself, treatment modality, treatment process, nor the interaction of any combination of these variables predicted posttreatment response with any regularity.

Presumptive Causal Chains

A review of all tested causal chains suggests that perhaps as many as 15 may have successfully linked the interaction of treatment modality and matching variable to drinking outcome through a presumptive mediator. (It is not possible to conclude this with certainty because of various limitations in the causal chain analyses.) Again, a few summary comments are in order.

First, all canonical models (1, 2, 3A, and 3B) were represented in completely linked causal chains. Canonical model 3, which conceptualized an intervening variable as the consequence of treatment modality and client treatment matching variable, was most often successfully linked. Canonical model 2, which conceptualized a matching variable predictive of a client characteristic that interacted with a treatment process variable to affect drinking outcome, was

least often successfully linked. Model 1, which conceptualized a treatment modality leading to a treatment process that interacted with the client matching variable, was intermediate in success between models 2 and 3.

A second observation is that, as often as not, the causal chain was opposite the direction predicted. Of significance, when the causal chain was opposite that predicted, usually so was the matching effect that it was developed to explain (e.g., for sociopathy, self-efficacy, and gender). This consistency suggests that the matching effect was real; what was at variance with reality was the a priori theorizing.

A third observation, of considerable importance, is that (irrespective of whether they were hypothesized) most of the causal chains that appeared to be successfully linked occurred in the outpatient arm of study (13) rather than in aftercare (2). This is important because outpatient was a standalone treatment, whereas aftercare followed a more intensive treatment experience. It would be expected that a standalone treatment would be more likely to be amenable to a successful examination of mediators than would a treatment that was only the latter part of the whole treatment experience of the client. The greater robustness of the outpatient causal chain analyses corresponds with the greater robustness of the outpatient matching effects.

This concordance suggests that research utilizing standalone treatments is more likely to be informative.

Research Recommendations

Our interpretation of MATCH matching results is that we have observed several small single attribute by treatment modality interactions. From this conclusion, it follows that treatment strategies that rely on consideration of client attributes will need to find a better empirical foundation for their justification. We suggest some (nonmutually exclusive) avenues for future matching research.

Dedicated Treatments for Identified Clients

Treatment modalities can be developed to treat clients with singular outstanding characteristics, such as gender. Rather than expecting that CBT would be superior to TSF because of assumptions regarding its active ingredients that might affect women more than men, a treatment would be designed specifically to treat female alcohol abusers. Such treatments have been developed but have not been subjected to rigorous study as to whether they enhance treatment outcomes.

Matching Therapy Process to Client Attributes

The results of the causal chain analyses indicated that while treatment modality often did not relate to putative active ingredients in the treatment process as anticipated, these treatment process variables were themselves often predictive of client changes, including client drinking. This finding suggests the need to go beyond the "brand name" of the modality to identify differences in therapy behaviors that interact with different client attributes.

For example, in studying tapes of therapy sessions, Karno and colleagues (in press) found that over and above treatment modality, therapist behaviors interact with client characteristics to affect drinking outcomes. For clients who are assessed as high in emotional arousal, therapist behaviors that seek to focus on that arousal, as opposed to dampening the arousal, lead to better drinking outcomes. Similarly, for clients who are characterized by low emotionality, therapist behaviors that do not seek to enhance emotional arousal appear to lead to better drinking outcomes than therapist behaviors that seek to induce emotional arousal.

Karno et al. also found that therapist directiveness interacted with client resistance to affect drinking outcomes, such that clients with high resistance had poorer outcomes with directive therapists, while those with low resistance had poorer outcomes with less directive therapists. These interactions accounted for more variance than did treatment modality and suggest that variability in therapist behavior unrelated to treatment modality interacts with client characteristics to affect drinking outcomes. Karno is currently conducting a replication study of these findings with MATCH

audiovideo tapes (Karno and Longabaugh 2000).

Matching Multimodal Therapies to Multiple Patient Characteristics

Another approach to matching treatment to client attributes is to build decision trees into the therapy that will modify the treatment modalities to be received by the client on the basis of a multidimensional characterization of the client. This approach is illustrated by a clinical trial under way (Davidson et al. 2000). Gulliver and Longabaugh (2000) have developed a broad spectrum treatment that selects modules to be delivered to the client on the basis of assessments of functioning and alcohol-specific support in five domains: cognitive impairment, family relationships, occupation, residential stability, and social network. Dual classification of the client's level of functioning and support for abstinence in each of these domains leads to triage to different configurations of treatment modules.

A related approach is to match modules to clients on the basis of client choice. This approach is being used in Project COMBINE (2000). Here, a combined behavioral intervention employing the principles of motivational interviewing (Miller and Rollnick 1991) leads clients to develop their own change plans and then select from a large number of modules available to facilitate achievement of this change plan (Miller 2001). In this approach, client choice is viewed as the result of the interaction of client self-assessment and therapy alternatives offered.

Hierarchical Algorithms for Selecting Treatment Options

If we look outside the field of alcohol treatment to therapy for psychiatric problems more generally, a more elaborate theory of systematic treatment selection nests matching principles within a hierarchy of decision trees to be applied to a given patient's treatment. The systematic treatment selection model developed by Beutler and associates (2000) describes such an approach. For purposes of illustration, we will superimpose this model on our study.

Beutler and colleagues have proposed empirically supported principles for systematic selection of treatment for depression. To date, they believe that six dimensions are important in guiding selection of treatment for the patient: functional impairment, subjective distress, experienced social support, problem complexity/chronicity, level of resistance, and coping style. They find empirical support for relationships between these variables and treatment.

Seven variables of treatment believed to be important are treatment intensity/duration, emotional focus, interpersonal focus, insight versus behavioral focus, breadth of treatment focus, directiveness of therapy, and the extent to which therapy is symptom focused. They have observed that present treatment modalities are only loosely associated with these dimensions. Consequently, they believe that in order to find lawful relations between these treatment dimensions and patient characteristics, it is necessary to tailor treatment behaviors (rather than treatment modalities) to patient characteristics.

Project MATCH matching variables can be grouped within the six characterizations of patients by Beutler et al. Functional impairment subsumes alcohol involvement, alcohol dependence, psychiatric severity, cognitive impairment, social dysfunction, and by inference, lack of confidence in maintaining abstinence and temptation to drink. Subjective distress may subsume motivational readiness, alcohol problem recognition, and meaning seeking. Experienced social support could subsume network support for drinking, religious background and beliefs, and prior AA involvement. Problem complexity is poorly represented in the MATCH domain, perhaps indexed by Axis I-comorbidity. Level of resistance encompasses anger, interpersonal dependence, and as used in MATCH, gender. Finally, coping style (inwardly directed vs. externally focused) maps readily on to sociopathy, ASPD, and A versus B typology. In this conceptualization, MATCH variables within each of these domains could be considered alternative or overlapping proxy measures for each construct.

As anticipated, however, mapping the three MATCH treatment modalities into Beutler et al.'s seven dimensions of treatment is not possible. Only a few correspondences can be

estimated with any confidence. Treatment intensity/length can be mapped. Inpatient plus aftercare treatment is more extensive and intensive than standalone MATCH outpatient treatments. Within each treatment arm, MET is less extensive and intensive than either CBT or TSF. Because TSF aims to involve the client in AA during and after treatment, while CBT does not, TSF could be considered to be more intensive than CBT.

Treatment directiveness can also be mapped, with CBT and TSF considered to be more directive than MET. Symptom focus might be captured in the contrast of CBT versus MET, with CBT being more symptom focused. The three treatments cannot be differentiated with any confidence on the remaining dimensions.

Mapping Project MATCH interactions on to Beutler et al.'s interface of treatment intensity with social support and problem impairment supports their hypothesis that greater impairment and lesser support require greater treatment intensity. The interface of treatment directiveness and client resistance supports the MATCH interactions involving anger and interpersonal dependency, and MET versus CBT and TSF supports the hypothesis that greater resistance requires less directiveness. The interface of symptom focus with patient coping style is less clear, but MATCH interactions between CBT and sociopathy, ASPD, and typology were observed.

In summary, hypotheses derived from the Beutler et al. systematic treatment selection model appear to explain many of the interactions observed in MATCH. Characterization of the treatments by actually observed therapist behaviors (Karno 2000) will put several of Beutler's matching predictions to a direct empirical test.

Commentary

Irrespective of the theoretical approach taken to matching, it is clear that any model that rests on single client attribute-treatment interactions will not suffice. Rather, if matching is going to enhance treatment outcomes, multidimensional matching algorithms will be needed. It is likely that such models must encompass nonlinear relationships as well. Matching effects may not be simply additive. For example, if a client is mismatched with treatment on one important characteristic this may well nullify matching synergies on a number of other dimensions. Whether treatment research will ever reach this level of sophistication remains to be seen.

Recommendations for Alcohol Treatment Research

Up until now we confined our commentary to recommendations regarding treatment matching and treatment matching research. In this section, we close with a series of recommendations concerning alcohol treatment research more generally.

Need for Study of the Treatment Process

The causal chain analyses conducted to test the theory underlying the matching predictions indicated that we have little idea what the active ingredients of treatment are nor how they affect patients more generally as well as patients with specific attributes. The "black box of treatment" identified by Moos and Finney 20 years ago (Moos et al. 1980) still remains pretty much a mystery. While we have been able to identify some general elements of treatment (e.g., working alliance) as modest predictors of enhanced outcome, as of yet we know little about the process that brings about this better alliance.

The examination of putative mediators in the present volume revealed that ingredients of a treatment that we expected to impact differentially on clients with certain attributes frequently failed to do so in the ways anticipated. This might be regarded as simply a shortcoming of matching theory. However, an investigation of the putative active ingredients of Cognitive-Behavioral Therapy (Morgenstern and Longabaugh 2000) indicated that the active ingredients of this popular and well studied therapy were also yet to be identified. So our ignorance of how treatments work extends beyond matching theories to our theories of treatment.

As the present volume has amply demonstrated, our theories about how treatment

works need to be operationalized and tested. Not to do so permits us to forge ahead while operating under false assumptions. That is no way to build a knowledge base about treatment.

So, the strongest recommendation we have regarding treatment research is that the treatment process itself has to be studied, through mediator analysis or other means, and related to treatment outcomes. We need to know what the mechanisms are that give rise to better outcomes. To do so will markedly affect the sophistication of theories about treatment.

Need for Study of the Treatment Context

As has been said on numerous occasions, treatment is but one small event in the life of an alcohol troubled person. Treatment takes place in a context: What factors bring the client to treatment, what is going on in the client's life while the treatment is delivered, and what environmental context awaits the client completing treatment? Until we understand these treatment context variables and bring them into our treatment models, we will be unable to account for major variance in treatment outcomes.

In the present study, such effects were implied by the disappearance of within-treatment matching effects after treatment was completed as well as the treatment by time interaction effects observed while treatment was going on. Also pertinent, the one matching effect that appeared 3 years after treatment identified variables outside of the treatment itself as a moderator (network support for drinking) and a mediator (attendance at AA meetings). Environmental context and interface needs to be brought directly into our models and either controlled for or systematically varied.

Measure Outcomes at the End of Treatment

In research on psychosocial treatments we usually designate "outcome" as a sustained period following treatment completion. We do so in the belief that the changes that occur because of treatment are sustaining and will enable the client to successfully cope with drinking during this posttreatment period. How long treatment effects last is an important question, but it is not the only important question. Also important is: Does treatment affect change in the client while it is ongoing or by its completion? If this does not happen, clearly the theory of treatment is either incorrect or has not been implemented as conceptualized. Thus, unless the theory underlying the treatment clearly specifies that its effects are not to become apparent until a specified time after treatment has been completed, the posttreatment observation is not a direct test of the theory.

This expectation of sustaining benefits of treatment is not present in most studies of pharmacotherapies. Here, the question is usually whether the client is changed while taking the medication. Whether the client continues to drink less after the completion of a trial of naltrexone, for example, is viewed as an interesting question but not one that speaks to the efficacy of the drug itself. Why is it that we should expect so much more from psychosocial therapies than from pharmacotherapies?

Studies of mechanisms should be designed to test as directly as possible the effects of these mechanisms on the designated dependent variable. Once mechanisms have been identified, they can be continued or terminated as part of the treatment. Studies of behavioral therapies (like studies of pharmacotherapies) suggest that their effects are likely to last as long as the treatment is ongoing. If that is so, what is it that precludes our conceiving of psychosocial treatments as having maintenance phases which might go on indefinitely? Treatment so conceived might well prove to be more cost effective than repeated "acute phase" treatments.

Measuring Outcome

In alcohol treatment outcome studies, the primary dependent variable is typically a measure of drinking (frequency, intensity, total volume, or some composite of these). Secondary measures of outcome may include measures of functioning, subjective well-being, service utilization, and the like. Project MATCH was prototypic in this regard. Yet many of our treatment theories do not specify a direct impact of the treatment on drinking per se. In MATCH, for example, it was expected that TSF clients would stop drinking as a consequence of working the

12 steps that require major cognitive, attitudinal, and behavioral changes. CBT was expected to improve the client's cognitive-behavioral coping skills, while MET was focused on increasing client motivation to change. Assuming these foci of treatment are accomplished, a change in drinking is expected to follow.

Depending upon the underlying theory of treatment, drinking may not be conceived of as the primary dependent variable. For example, drinking may be seen as one mediator of enhanced quality of life. If people drink less, they are expected to experience fewer negative consequences from drinking and positive consequences from not drinking. However, if cessation of drinking does not lead to one, the other, or both of these effects, enhanced quality of life will not occur. Thus, change in drinking status is one link in the supporting causal chain.

In contrast is a theory that relies on enhanced quality of life as a mediator of change in drinking. In this scenario, the treatment leads to increased quality of life that in turn results in a reduction in drinking. If quality of life does not improve, drinking will not diminish. Thus, depending upon the underlying causal chain, drinking may be a mediator variable, a dependent variable, or both.

Our interest in alcohol treatment is in reducing or eliminating the negative consequences of drinking rather than ending drinking itself. Thus, the negative consequences from drinking should be the primary measure of outcome. Measures of drinking may be important or critical to testing various parts of the theory of treatment, but they are neither necessary nor sufficient as primary measures of alcohol treatment outcomes.

The Need for Inclusion of Multiple Treatment Sites

If Project MATCH has taught us only one thing, it is the risk involved in conducting single-site studies. Had we not included multiple sites and different study arms and had conducted the study in just one treatment site, we would have found an effect that we assumed could be generalized. Instead, subtle and as yet unidentified variables led to inconsistencies of effects across sites and settings. In order to begin to test for generalizability of effects beyond a single treatment site, it would appear that, despite the additional cost, inclusion of at least two sites in a treatment outcome study are necessary.

Conclusion

Our predictions as to how treatments would be distinctive in ways that would differentially impact clients with specific attributes were woefully inadequate. A major conclusion is that we do not know yet how our treatments work. The theories developed to support matching predictions were not adequate for the task.

Several caveats are in order. While the development and testing of the a priori matching hypotheses was exceedingly rigorous and analytically appropriate, in hindsight, the development and testing of causal chains was not. There are several reasons for this.

First, when Project MATCH was initiated (1989), mediational analyses were not widely known to the alcohol treatment research community. The seminal paper by Baron and Kenny had only been published in the Journal of Personality and Social Psychology in 1986. Holmbeck's paper clarifying some of the ambiguities in testing for mediational effects was not published until 1997, after the MATCH causal chain analyses had been completed. Thus, from an historical perspective, the causal chain analyses were undertaken in Project MATCH before the methodological and statistical techniques were fully developed. Even to the present, analyses have been confined largely to testing for mediation of main effects. In Project MATCH, we sought to push the envelope by initiation of mediational analyses of moderator effects, a novel topic even a decade later.

Compounding this difficulty, the senior scientists selected to conduct the MATCH trial were trained in an era before mediational analysis had become prominent. As a group, we were not especially well trained in these new methodologies. Further, there were differences among MATCH investigators regarding the importance of a priori theory development. Some investigators believed, in reflection quite accurately, that elaborate theory development was

premature and expected that the facts would emerge in due course.

Because we were breaking new ground, there was not a consensus on the best analytic tools to test the causal chains for moderating variables. Consequently, each matching hypothesis team was free to adopt whatever analytic tools made sense to them for testing their causal chain. The variety of approaches adopted is quite apparent as one reads across the chapters.

Because of the need to implement Project MATCH on a timeline close to that projected and funded, the study was implemented before the theories underlying the matching predictions had been fully elucidated. This meant that matching hypotheses were guided by a theoretical orientation rather than derived from a completed theory of which they were a part. Clearly, many of the assumptions underlying the matching predictions proved to be incorrect. Had theories been fully explicated earlier, it would have been apparent that many involved assumptions that would be untenable or at least previously untested.

There was also the necessity of relying on the assessment battery that had been adopted and was already being implemented prior to the completion of causal chain development. This resulted in proxy indices for pivotal mediators for many of the causal chains tested. Further, the number of measures of treatment process that transcended the three treatments was limited by assessment time and MATCH priorities. As so many matching hypotheses were to be tested, the allocation of resources to assessing any one was necessarily limited. Finally, while the three treatments developed for testing matching hypotheses were believed to be distinctive from one another, they were not developed to be distinctive in their relations to the matching variables, which were still to be decided upon.

It is our hope that the Project MATCH study of mediational analyses of moderator effects, now concluded, will provide guidance to treatment researchers as they develop theories and test interventions to enhance treatment outcomes.

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Appendix 1. Observed interactions, Outpatient Arm[1]

Client variable		Within treatment			One year posttreatment			Months 37–39 posttreatment		
		CBT vs. MET	TSF vs. MET	CBT vs. TSF	CBT vs. MET	TSF vs. MET	CBT vs. TSF	CBT vs. MET	TSF vs. MET	CBT vs. TSF
Alcohol Dependence	PDA									
	DDD									
Alcohol Involvement	PDA									
	DDD									
Cognitive Impairment	PDA									
	DDD									
Psychiatric Severity/ Psychopathology	PDA	CBT >MET*	TSF v MET[T, Dx]	CBT v TSF*		TSF v MET[T]	CBT > TSF*[f5–11]			
	DDD									
Sociopathy/ ASPD	PDA	MET > CBT				TSF v MET[T]				
	DDD		TSF > MET*[T11,12 A]							
A-B Typology	PDA									
	DDD							CBT > MET	TSF > MET	
Anger	PDA				MET > CBT*	MET > TSF*		MET > CBT*	MET > TSF*	
	DDD				MET > CBT*	MET > TSF*		MET > CBT*	MET > TSF*	
Conceptual Level	PDA									
	DDD					TSF v MET[T]				
Meaning Seeking	PDA									
	DDD									
Religiosity	PDA									
	DDD				CBT v MET[T]					
Interpersonal Dependency	PDA				CBT > MET					
	DDD							CBT > MET	TSF > MET	
(Female) Gender	PDA		TSF > CBT							
	DDD									
Motivational Readiness	PDA			CBT v TSF[T]	MET >CBT*[T15]		TSF > CBT[T–]			
	DDD			CBT v TSF[T]			TSF > CBT[T–]			
Problem Recognition	PDA				CBT v MET[T]					
	DDD	CBT v MET[T]								
Self-Efficacy	PDA									
	DDD				MET > CBT					
Temptation minus Confidence	PDA									
	DDD									

Network Support for Drinking	PDA		TSF > MET*T1-4						TSF > MET*	
	DDD		TSF > MET*T1-5						TSF > MET*	
Prior AA	PDA	MET > CBT			MET > CBT	TSF v MET1				
	DDD	MET > CBT								
Social Functioning	PDA				MET > CBT		TSF > CBT			
	DDD				MET > CBT		TSF > CBT			

1 Positive entries in the table are derived from results reported in the four Project MATCH publications (Project MATCH, 1997*a*, 1997*b*, 1998*a*, 1998*b*) and from the tables provided in the chapters in this volume. All entries indicate that the observed *p* value for the test was $p \leq .05$.

v Indicates an interaction of time, treatment modality, and client attribute in which the direction of the treatment contrast by client attribute interaction is unknown, either because it was not reported or the interaction involved quadratic time, precluding easy description.

> When the dependent variable is percentage of days abstinent, indicates that the slope of the first treatment is significantly more positive than the slope of the second treatment (even under the condition that both slopes are negative (decreasing with increasing values of the client matching variable)). When the dependent variable is drinks per drinking day, > indicates that the slope of the first treatment is more steeply negative.

* Indicates that the direction of the contrast was hypothesized a priori. No asterisk indicates either that the result was opposite that hypothesized or that no a priori hypothesis had been offered regarding the observed interaction.

T Indicates an interaction of client attribute, treatment, and time that reached $p \leq .05$ level. Numbers following the T indicate the weeks (if a within-treatment effect) or months (if a posttreatment effect) in which the contrast was significant at $p \leq .05$. If no numbers follow the T, either differences between the contrasts were not tested for specific intervals, were not reported, or tests were conducted and none of the intervals contrasted were significant at the $p \leq .05$ level, despite evidence of an overall time by treatment by client attribute interaction.

+ indicates the effect is increasing with time.

– indicates the effect is decreasing with time.

A Indicates that the contrast entered was significant for antisocial personality disorder but not for sociopathy. Entries for this construct not accompanied by an A were significant for sociopathy or for sociopathy and antisocial personality disorder.

Dx Indicates that the contrast was significant for DIS Axis I personality disorder but not for ASI psychiatric severity. Entries for which a Dx is not entered are significant either for both ASI psychiatric severity and DIS Axis I diagnosis or for ASI psychiatric severity alone.

f Accompanied by numbers indicates that an attribute by treatment interaction was observed as well as an attribute by treatment by time interaction. The numbers indicate the intervals during which the contrast was significant.

Appendix 2. Observed interactions, Aftercare Arm[1]

Client variable		Within treatment			One year posttreatment		
		CBT vs. MET	TSF vs. MET	CBT vs. TSF	CBT vs. MET	TSF vs. MET	CBT vs. TSF
Alcohol Dependence	PDA						TSF > CBT*
	DDD	CBT v MET^{T}					TSF > CBT*
Alcohol Involvement	PDA						
	DDD		TSF v MET^{T}				
Cognitive Impairment	PDA	CBT > MET*^{T}					
	DDD	CBT > MET*^{T}		CBT > TSF*^{T}			
Psychiatric Severity/ Psychopathology	PDA						
	DDD						
Sociopathy/ ASPD	PDA						CBT>TSF*^{A,T}
	DDD			CBT > TSF*^{A}	CBT>MET*$^{A, T4''}$		CBT>TSF*^{A,T4,5}
A–B Typology	PDA						
	DDD				MET v CBT*^{T}		
Anger	PDA						
	DDD						
Conceptual Level	PDA						
	DDD						
Meaning Seeking	PDA					TSF > MET*^{T}	TSF > CBT*^{T}
	DDD						
Religiosity	PDA						
	DDD						
Interpersonal Dependency	PDA						
	DDD						
(Female) Gender	PDA		TSF v MET^{T}				
	DDD		TSF v MET^{T}				
Motivational Readiness	PDA	CBT > MET			CBT > TSF		
	DDD						
Problem Recognition	PDA				CBT > MET^{T4,5}		TSF > MET^{T4,5}
	DDD						TSF > MET^{T4}
Self-Efficacy	PDA	CBT > MET*	TSF > MET*				
	DDD	CBT > MET*					
Temptation minus Confidence	PDA	CBT > MET					
	DDD		TSF > MET*$^{T1–3}$				
Network Support for Drinking	PDA	CBT v MET^{T}					
	DDD	CBT v MET^{T}					
Prior AA	PDA		MET > TSF^{T+}				
	DDD		MET > TSF^{T+}				
Social Functioning	PDA						TSF>CBT$^{T4,5,14–15e}$
	DDD						

1 Positive entries in the table are derived from results reported in the four Project MATCH publications (Project MATCH, 1997a, 1997b, 1998a, 1998b) and from the tables provided in the chapters in this volume. All entries indicate that the observed p value for the test was $p \leq .05$.

v Indicates an interaction of time, treatment modality, and client attribute in which the direction of the treatment contrast by client attribute interaction is unknown, either because it was not reported or the interaction involved quadratic time, precluding easy description.

> When the dependent variable is percentage of days abstinent, indicates that the slope of the first treatment is significantly more positive than the slope of the second treatment (even under the condition that both slopes are negative (decreasing with increasing values of the client matching variable)). When the dependent variable is drinks per drinking day, > indicates that the slope of the first treatment is more steeply negative.

* Indicates that the direction of the contrast was hypothesized a priori. No asterisk indicates either that the result was opposite that hypothesized or that no a priori hypothesis had been offered regarding the observed interaction.

T Indicates an interaction of client attribute, treatment, and time that reached $p \leq .05$ level. Numbers following the T indicate the weeks (if a within-treatment effect) or months (if a posttreatment effect) in which the contrast was significant at $p \leq .05$. If no numbers follow the T, either differences between the contrasts were not tested for specific intervals, were not reported, or tests were conducted and none of the intervals contrasted were significant at the $p \leq .05$ level, despite evidence of an overall time by treatment by client attribute interaction.

+ indicates the effect is increasing with time.

– indicates the effect is decreasing with time.

A Indicates that the contrast entered was significant for antisocial personality disorder, but not for sociopathy. Entries for this construct not accompanied by an A were significant for sociopathy or for sociopathy and antisocial personality disorder.

Dx Indicates that the contrast was significant for DIS Axis I personality disorder, but not for ASI psychiatric severity. Entries for which a Dx is not entered are significant either for both ASI psychiatric severity and DIS Axis I diagnosis or for ASI psychiatric severity alone.

e Estimated.

Appendix 3. Prognostic effects of matching variables, Outpatient and Aftercare Arms, on percentage of days abstinent and drinks per drinking day

Client variable	Outpatient Arm				Aftercare Arm	
	4–15 months		37–39 months		4–15 months	
	PDA	DDD	PDA	DDD	PDA	DDD
Alcohol Dependence	+		+		⊕	+⊕
Alcohol Involvement	+T+15	−T−15	+	−	−T	+
Cognitive Impairment						
Psychiatric Severity/Psychopathology	⊕				−T+	+T+
Sociopathy/ASPD	−⊕T−	+T−			⊕	⊕
A-B Typology	+		+	⊕		⊕
Anger	⊕	⊕	⊕	⊕		
Conceptual Level		⊕				
Meaning Seeking			+		⊕	
Religiosity		−⊕		−	+	
Interpersonal Dependency	⊕			⊕		
Gender (female)					+	−T+
Motivational Readiness	+⊕	−⊕	+	−		
Problem Recognition	+⊕	−	+	−	⊕	⊕
Self-Confidence	+	−⊕		−		
Temptation minus Confidence	−	+		+	−	+
Network Support for Drinking	−	+	⊕	+⊕	−	+
Prior AA			+			
Social Dysfunction	+⊕	⊕	+		⊕	

+ = positive relationship between client variable and drinking variable ($p \leq .05$)

− = negative relationship between client variable and drinking variable ($p \leq .05$)

T+ = An Interaction with Time such that the prognostic effect of the client variable increases with Time ($p \leq .05$)

T− = An Interaction with Time such that the prognostic effect of the client variable decreases with Time ($p \leq .05$)

⊗ = An Interaction between Treatment and client attribute observed at $p \leq .05$ level (two directional) during this period. (Includes attribute by treatment by linear time only)

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